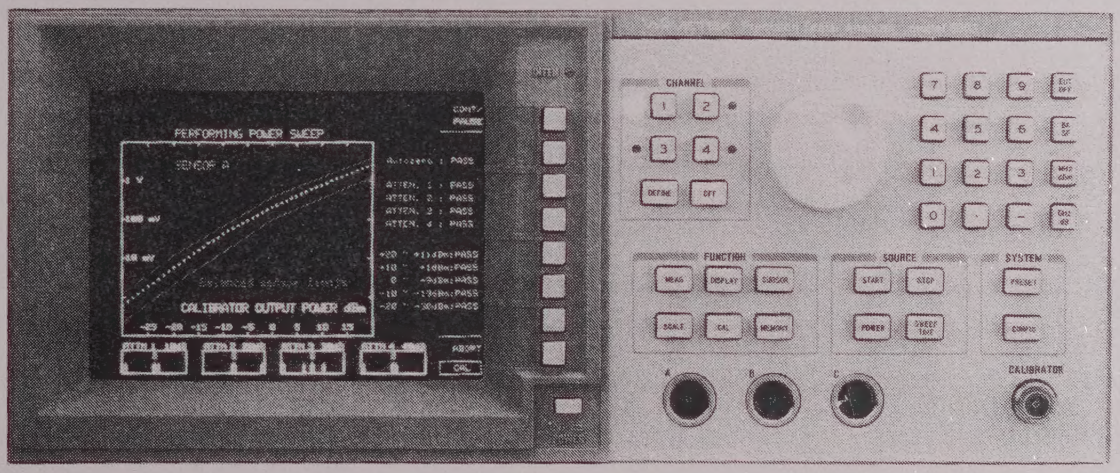
# Model 8003
# Precision Scalar Analyzer




# Maintenance Manual

INSTRUMENT SERIAL NUMBER _____


## WAVETEK MICROWAVE, INC.

488 TASMAN DRIVE, SUNNYVALE, CA. 94089
TEL: (408) 734-5780 TWX: 910-339-9273 TELEX: 371-6460

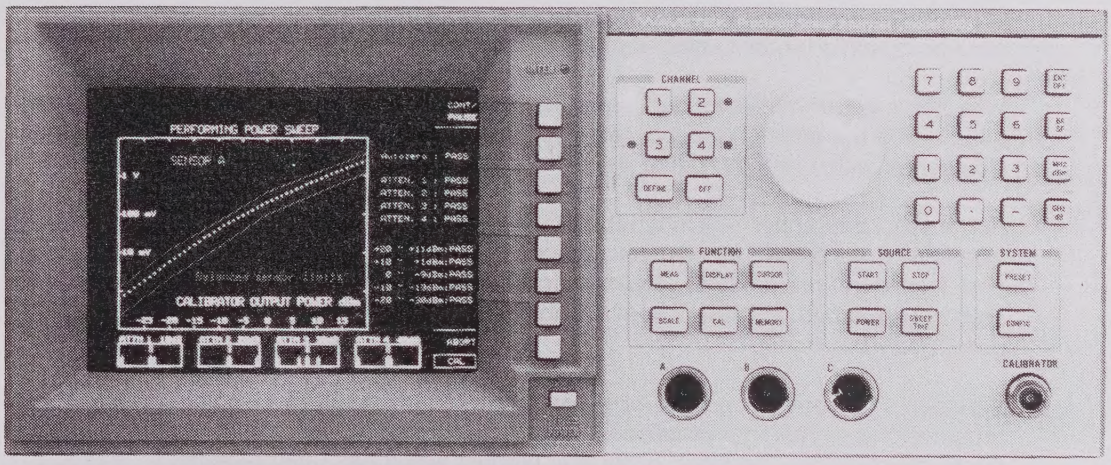


1499-20791-001
Code 11 (11-89)

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_09515

# Model 8003
# Precision Scalar Analyzer




## Maintenance Manual

INSTRUMENT SERIAL NUMBER _____


## WAVETEK MICROWAVE, INC.

488 TASMAN DRIVE, SUNNYVALE, CA. 94089
TEL: (408) 734-5780 TWX: 910-339-9273 TELEX: 371-6460



1499-20791-001
Code 11 (11-89)

# WARRANTY

Wavetek warrants that all products manufactured by Wavetek conform to published Wavetek specifications and are free from defects in materials and workmanship for a period of one (1) year from the date of delivery when used under normal operating conditions and within the service conditions for which they were furnished.

The obligation of Wavetek arising from a Warranty claim shall be limited to repairing, or at its option, replacing without charge any product which in Wavetek's sole opinion proves to be defective within the scope of the Warranty. In the event Wavetek is not able to modify, repair, or replace non-conforming defective parts or components to a condition as warrantied within a reasonable amount of time after receipt thereof, Buyers shall be credited for their value at the original purchase price.

Wavetek must be notified in writing of the defect or non-conformity within the Warranty period, and the affected product returned to Wavetek's factory or to an authorized service center within (30) days after discovery of such defect or non-conformity.

For product warranties requiring return to Wavetek, products must be returned to a service facility designated by Wavetek. Buyer shall prepay shipping charges, taxes, duties, and insurance for products returned to Wavetek for warranty service. Except for products returned to Buyer from another country, Wavetek shall pay for return of products to Buyer.

Wavetek shall have no responsibility hereunder for any defect or damage caused by improper storage, improper installation, unauthorized modification, misuse, neglect, inadequate maintenance, accident, or for any product which has been repaired or altered by anyone other than Wavetek or its authorized representative and not in accordance with instructions furnished by Wavetek.

## Exclusion of Other Warranties

The Warranty described above is Buyer's sole and exclusive remedy and no other warranty, whether written or oral, is expressed or implied. Wavetek specifically disclaims the implied warranties of merchantibility and fitness for a particular purpose. No statement, representation, agreement, or understanding, oral or written, made by an agent, distributer, representative, or employee of Wavetek, which is not contained in the foregoing Warranty will be binding upon Wavetek, unless made in writing and executed by an authorized Wavetek employee. Under no circumstances shall Wavetek be liable for any direct, indirect, special, incidental, or consequential damages, expenses, losses, or delays (including loss of profits) based on contract, tort, or any other legal theory.

Copyright 1989 by Wavetek Microwave, Inc.

Printed in the United States of America. The information contained in this manual is intended for the operation and maintenance of Wavetek Microwave equipment and is not to be used otherwise or reproduced without the written consent of Wavetek Microwave, Inc.

# TABLE OF CONTENTS

Page No.

## Chapter M1 Electrical Description

General . . . . . M1-1
Power Supply PC Board (#A1)

General . . . . . M1-7
Switching Power Supply . . . . . M1-7

Regulator . . . . . M1-7
DC - DC Converter . . . . . M1-10
Post Regulators . . . . . M1-10

CRT Display

General . . . . . M1-11
Horizontal . . . . . M1-11
Vertical . . . . . M1-13

CRT Cathode PC Board (#A2)

Video Amplifiers . . . . . M1-15
G1 Circuit . . . . . M1-15
Adjustments . . . . . M1-15

Front Panel (#A3) & Peripheral/Memory (#A10) PC Boards

Front Panel Board . . . . . M1-17
Peripheral/Memory Board . . . . . M1-17

Keyboard Decoder & Spin Knob Control . . . . . M1-18
Dynamic RAM Control . . . . . M1-18
VME Bus Interface . . . . . M1-19
Non-Volatile RAM . . . . . M1-19
Vector Interrupt Control . . . . . M1-19
Sound Generation . . . . . M1-19
Private GPIB Control . . . . . M1-19

Analog Interconnect PC Board (#A4) . . . . . M1-21

# TABLE OF CONTENTS

Page No.

## Chapter M1 Electrical Description (cont.)

Calibrator PC Board (#A5)

Introduction ..... M1-25
General ..... M1-26
50 MHz Oscillator ..... M1-27
RF Output ..... M1-27
Oven ..... M1-27
Thermistor Bridge ..... M1-28
Track & Hold and DAC ..... M1-28
Correction Thermistor Circuit ..... M1-28
Calibrator NVRAM Control Circuit ..... M1-29
Sensor NVRAM ..... M1-29
Sensor Interrupt ..... M1-29
Digital Control Circuit ..... M1-29

Analog PC Board (#A6)

General ..... M1-33
Detector Amplifiers ..... M1-33

Amplifier Offset Supplies ..... M1-34

A to D Conversion ..... M1-35
Temperature Sensing ..... M1-35
Digital Control Interface ..... M1-36

Digital Interconnect PC Board (#A9) ..... M1-37
Graphics PC Board (#A11)

General ..... M1-41
Graphics Controller ..... M1-41
Color Planes ..... M1-41
RGB Output Description ..... M1-43

# TABLE OF CONTENTS

Page No.

## Chapter M1 Electrical Description (cont.)

CPU PC Board (#A12)

General ..... M1-45
Microprocessor ..... M1-45
Interrupt Control ..... M1-45
VME Bus ..... M1-46
Real Time Clock ..... M1-46
RS232 Serial Port ..... M1-46
System GPIB ..... M1-47
System Reset ..... M1-47

Rear Panel PC Board (#A13)

General ..... M1-51
D to A Conversion ..... M1-51
A to D Conversion ..... M1-51
Blanking Input ..... M1-51
Input 1 ..... M1-52
Digital Address Decoding ..... M1-52

Modulator PC Board ..... M1-53

## Chapter M2 Maintenance

Introduction ..... M2-1
Periodic Maintenance ..... M2-1
**Calibration** ..... M2-2

Equipment Required ..... M2-5
Calibration Checks and Adjustments ..... M2-5

Lithium Battery Check ..... M2-5
Power Supply Check ..... M2-6
Display Check ..... M2-7
Center Display ..... M2-8
Check Front Panel Key Operation ..... M2-9
Set Time and Date ..... M2-9
Calibrator Check ..... M2-9

# TABLE OF CONTENTS

Page No.

## Chapter M2 Maintenance (cont.)


Sensor Calibration Check ..... M2-11
Check Sensor EEPROMS ..... M2-12
Check Private GPIB ..... M2-12
Check System Functions ..... M2-12
Check Preset ..... M2-12
Check Source Functions on Front Panel ..... M2-13
Check Sweep Time ..... M2-13
Check Cal Zero ..... M2-13
Path Cal Test ..... M2-14
AC Detection Test ..... M2-14

**Calibration Check Data Recording Sheet** ..... M2-15

Troubleshooting Procedures ..... M2-17

Equipment Required ..... M2-17
Preliminary Steps ..... M2-17
Model 8003 Basic Troubleshooting Flow Chart ..... M2-19
Model 8003 Power Supply PC Board Troubleshooting Flow Chart ..... M2-20
Model 8003 Calibrator PC Board Troubleshooting Flow Chart ..... M2-21
Model 8003 Analog PC Board Troubleshooting Flow Chart ..... M2-22
Model 8003 Peripheral/Memory PC Board Troubleshooting Flow Chart ..... M2-23
Model 8003 Graphics PC Board Troubleshooting Flow Chart ..... M2-24
Model 8003 CPU PC Board Troubleshooting Flow Chart ..... M2-25
Model 8003 Rear Panel PC Board Troubleshooting Flow Chart ..... M2-26

Lithium Battery Replacement ..... M2-28

Battery Replacement Procedure ..... M2-28


## Chapter M3 Schematic Diagrams (SD) and Assembly Drawings


Index to the Locations of Schematic Diagrams and Assembly Drawings ..... M3-1

# TABLE OF CONTENTS

Page No.

## Chapter M4 Replaceable Parts Listings

Index to the Locations of Replaceable Parts Descriptions . . . . . .M4-1

## Tables And Illustrations

Table M1-A Model 8003 Circuit Assemblies . . . . . .M1-2

Figure M1-A Model 8003 Overall System Block Diagram . . . . . .M1-2A
Figure M1-1 Power Supply/CRT Display Block Diagram . . . . . .M1-5
Figure M1-2 Calibrator PC Board Block Diagram . . . . . .M1-23
Figure M1-3 Calibrator Internal Power Standard Configuration . . . . . .M1-25
Figure M1-4 Analog PC Board Block Diagram . . . . . .M1-31
Figure M1-5 Graphics PC Board Block Diagram . . . . . .M1-39
Figure M1-6 Graphics Controller Vertical & Horizontal Timing Diagram . . . . . .M1-42
Figure M1-7 Rear Panel PC Board Block Diagram . . . . . .M1-49

Figure M2-1 Location of 8003 Calibration Components . . . . . .M2-3
Figure M2-2 Calibrator Output Power Reference Level Test Setup . . . . . .M2-9
Figure M2-3 Display of Calibrated Path . . . . . .M2-14
Figure M2-4 Position & Location of Switches and Jumpers for the Indicated PC Boards . . . . . .M2-27

# Power Supply PC Board (#A1)

(See Figure M1-1 on page M1-5 and SD 19176 on page M3-9)

## GENERAL

Referring to Figure M1-1, it can be seen that the power supply circuitry is divided into two general sections. These consist of a switching power supply to convert the ac line voltage into dc voltages for the rest of the instrument, and a display section to drive the CRT.

## SWITCHING POWER SUPPLY

The switching power supply can be divided into three main blocks. These are:

The regulator which turns the ac input voltage into a constant "Reg. V" of about 180V DC.

The DC to DC converter which converts the "Reg. V" into +5V and several unregulated voltages.

The post regulators which turn the unregulated voltages into tightly controlled output voltages for the rest of the instrument.

### Regulator

(Sheet 1 of the SD)

## AC RECTIFICATION

The ac line voltage is converted to an unregulated dc "HV" by bridge rectifier CR5 and storage capacitors C6 and C8. This power supply accepts a dual input voltage range, 90 to 130VAC or 180 to 260 VAC. In the lower range the line selector card connects CR5 as a voltage doubler instead of a bridge, keeping the HV voltage the same in both ranges.

## LINE OVER-VOLTAGE

An over-voltage circuit guards the regulator against excessive voltage on C6 and C8 which might occur if the line selector card were improperly installed. If the HV voltage exceeds the sum of the zener voltages of CR9 and CR10 (about 400V), current will start to flow through R2 and R6. This will develop enough gate-to-source voltage to turn on P-channel FET Q1. This, in turn, will

fire SCR CR7 and blow the line fuse, thus removing the over-voltage condition. L2 limits the dI/dT of CR7 during turn-on to acceptable limits. CR6 and CR11 block CR7 from also discharging C6 and C8 as this would exceed CR7's current rating.

## SWITCHING REGULATOR

The "HV", which can vary between 220 and 360V, is regulated to about 180V by the duty cycle of the main switch transistor Q2. The exact value is controlled to regulate the 5V output of the power supply. The 32 kHz rectangular waveform generated at the emitter of Q2 is smoothed to dc by L1 and capacitors C23 and C25. Free-wheeling diode CR14 provides current for L1 when Q2 is off. A "Reg. V" of approximately 180VDC is passed to the converter.

## Q2 DRIVE

U3 drives Q3 which, in turn, drives the primary of T3. The secondary of T3 drives the base of Q2 across the isolation boundry. CR17 and zener CR18 clamp the reset voltage of T3's primary to a maximum of 150V. CR12 and CR13 form a "Bakers clamp" which keeps Q2 from saturation by diverting excess drive current out of Q2's base to ensure quick turn off. CR15, R10, R12, and C9 speed the turn off by letting some of T3's reset current be drawn out of Q2's base.

## TIMING OSCILLATOR

U3 forms a saw-tooth oscillator with timing components C14 and R22. This oscillator is injection locked to the slightly faster converter. On the rising edge of the converter's "B Out", C32, C33, R65, R21, and CR21 inject a voltage spike onto the oscillator's waveform which terminates the cycle. Q2 is latched off during the discharge of C14, thus setting a maximum duty cycle of approximately 90%.

## VOLTAGE FEEDBACK

DC feedback through precision resistive divider R19 and R25 allows U3 to regulate the 5V output versus an internal reference. Installing W2 modifies the divider ratio which causes the 5V output to be either 5% high or 5% low. R15 and C10 form a feedback network to control the gain of the error amplifier in U3.

## FEEDFORWARD

U3 also monitors the peak current through main switch Q2. This

control loop "feeds-forward" variations in HV to control U3 which compensates for the variations before they effect the 5V output. This approach allows excellent rejection of the 120 Hz ripple present on HV, and easier stabilization of the voltage feedback loop. Transformer T2 senses the pulse current through main switch Q2, and reflects 1/50th as much current through R24. This develops a voltage proportional to Q2's current at TP11, REG CURRENT. R20 and C13 are a low pass filter to remove switching transients. U5A adds in a correction from the U3 oscillator waveform which is needed for stability of the current loop. U3 switches Q2 off when the voltage at its current sensing input reaches about 1V, and thus provides the added protection of cycle-by-cycle limiting of the switch current.

## 5V CURRENT LIMIT

(See sheet 3 of the SD)

The dc voltage drop across L5 (5V current x L5's resistance) is amplified by U4B. If U4B's output voltage exceeds about 3.1V (2.5V fed back to U3-2 by resistive divider R19 and R25 + one diode drop), CR19 will be forward biased and the supply will go into current limit.

## START-UP SUPPLY

The power to start the control circuitry running comes from the 60 Hz transformer T1. C1 is gradually charged up through CR2 and R176. When the voltage on C1 reaches 16V, U3 starts up and turns on Q7 and Q6 (Q6 and Q7 are shown on sheet 2 of the SD) applying 15V SW(itched) to U1, U2, and U4. These chips draw more current than T1 can provide but before C1 can discharge, the 15V output comes up and holds "15V LOC" up through CR3.

## AC FAIL

The AC Fail circuitry monitors the ac line voltage and warns the CPU of impending power outages. T1's output is full wave rectified by bridge CR1. This is divided down by R177 and R178. U6-1 discharges C3 eahc time the voltage at U6-3 exceeds an internal 1.3V reference. If the ac line does not exceed the low line voltage again in about 12 ms, C3 will charge up above 1.3V. This will be sensed by U7-3, and U7-1 will discharge C5. U7-6 senses the discharge of C5 and pulls "AC Fail" low. When ac power is restored, R181 will take about 1/2 second to charge C5 above 1.3V, giving all the supply voltages time to settle before sending "AC Fail" high. U7-7 fires the degauss circuit by sending "Degauss Trig" high when "AC Fail" goes high.

## DC-DC Converter
(Sheet 2 of the SD)

The converter takes "Reg. V" and produces lower dc voltages that are isolated from the line. One end of power transformer T5 is held at "Reg V"/2 by capacitive divider C23 and C25. The other end is alternatively pulled up to "Reg V" when FET Q4 is on, and pulled down to zero when FET Q5 is on. Thus, the primary of T5 is driven alternately by +1/2 and -1/2 "Reg V". +5V, +20V, -20V, +30V, +80V, and -160V are rectified and filtered from the secondaries of T5.

### CONTROL CIRCUITRY

Pulse width modulator U1 runs at a constant frequency and duty cycle. Timing capacitor C30 and resistor R62 set the oscillation frequency at about the same rate as the horizontal frequency of the display. "A Out" and "B Out" drive the gates of Q4 and Q5 through transformer T4. During the discharge of C30 both outputs are low, thus preventing both FETs from being on at the same time. If the 5V supply should go over-voltage, zener CR22 will trigger the shutdown pin of U1 which turns off the converter.

### PHASE LOCK LOOP

An NE565A phase lock loop IC, U2, is used to synchronize the converter to the display. The "Horizontal Out" signal from the display is ac coupled to U2-3, and synchronized with "B Out" from the converter. Capacitor C21 sets the time constant of the phase lock loop. The differential output from U2-6 and U2-7 is amplified and referenced to ground by U4A. The output voltage of U4A, "PLL", is applied through R47 to U1-9. As "PPL" is increased, C30's discharge current is decreased and U1's oscillator is slowed. If W6 is opened, the converter will run free.

## Post Regulators
(Sheet 6 of the SD)

### +5V REGULATOR

The +5V is controlled by the action of regulators. Series pass regulators provide accurate output voltages from the poorly controlled voltages rectified from the other secondaries of T5. The +15V and -15V regulators use discrete parts, while the other regulators are three pin ICs.

### +15V REGULATOR

FET Q3 is the series pass element for the +15V regulator. DC feedback from precision resistive divider R71 and R72 is com-

pared with the 5V reference IC, CR35, by U5B. The output of U5B drives the gate of Q3. If the voltage drop across current sense resistor R162 is too large, U5C provides foldback current limiting by pulling U5-13 up through CR49.

### -15V REGULATOR

The -15V regulator tracks the +15V. U4D measures ground and +15V through precision resistive divider R79 and R80. The output of U4D drives the gate of FET Q9, the series pass element. If the voltage drop across current sensing resistor R171 is too large, U4C provides foldback limiting by pulling U4-12 down through CR50.

### 5V STANDBY

(See sheet 4 of the SD)

A 3.6V lithium battery keeps the static RAM in the instrument powered up when the ac line voltage is turned off. Diodes CR33 and CR34 are or-ed with CR39 to pull the standby voltage up to 5V when the ac power is on. L6 and C78 provide filtering. Positive temperature thermistor RT3 provides current limiting.

## CRT DISPLAY

### General

The display circuitry can be divided into two blocks: Vertical and Horizontal. The vertical section drives current through the vertical yoke, sweeping the beam from the top to the bottom of the screen at a 60 Hz rate. The horizontal section drives current through the horizontal yoke, sweeping the beam from side to side at a 32 kHz rate. The horizontal section also generates the heater and high voltages for the CRT.

### Horizontal

(See sheet 4 of the SD)

The horizontal circuit is controlled by one half of IC U10. A shunt regulator at U10-11 provides 13V for the rest of the horizontal circuits in U10. An oscillator of about 32 kHz is formed at U10-5 by timing capacitor C83 and resistors R101 and R103 (adjustable for horizontal hold). Thermistor RT2 makes the oscillation frequency more stable. This oscillator is locked to the "Horizontal Sync" signal from the graphics board at U10-1. U10 controls the rest of the circuit through "Horizontal Out". This turns Q12 on and off, generating a 0 to 24V signal at the collector of Q12. This is ac coupled through C94 to a -12 to +12V gate drive for power FET Q11. The power for the circuit is the "Horiz V" (about 60V) fed to flyback transformer T7-3.

While Q11 is on, the current in T7's primary ramps up. At the

same time the current in the horizontal yoke ramps up, driving the beam linearly across the screen. When Q11 turns off, the voltage at its collector is driven up by the energy stored in T7 and the horizontal yoke. This reverses the current in the horizontal yoke, and returns the CRT beam to the left side of the screen during the retrace time. During its flyback pulse the secondaries of T7 generate 16kV for the anode of the tube, 3kV for the focus voltage and G2 voltage, 200V for the degauss circuit, and 5.1VAC for the cathode heater. C95 controls the shape of the flyback pulse. The inductance of L8 can be adjusted to control the horizontal width of the picture. Horizontal linearity coil L7 has an inductance that varies with current and improves the linearity of the picture.

Capacitor C90 (S-shaper) also affects the linearity. R105 feeds a small dc current through the yoke in one direction or the other to center the picture horizontally. Connecting W2 "Horz Off" stops the beam sweeping and turns off the flyback pulse, but lets the horizontal oscillator keep running.

## X-RAY PROTECTION

If the flyback pulse grows too large, the voltage at U10-6 will exceed the voltage of the reference zener CR41 at U10-7. This causes current to flow into C85. If C85 charges up, the horizontal half of U10 latches and stays off until power is recycled.

## DEGAUSS

The degauss circuit fires each time the instrument is powered up to clean any magnetic discoloration from the screen. As soon as the instrument is powered up, C97 starts to charge up to 200V through R117. About 1/2 second later, "Degauss Trig" from the AC Good goes high. This is ac coupled to the gate of power FET Q13 which turns on for about 10 ms, discharging C97. This causes and exponentially decaying sine wave of current to flow through the L-C combination of the degauss coil and C97, thus degaussing the tube.

## HORIZONTAL SWEEP MONITOR

The flyback transformer T7 generates 5.1VAC for the cathode heater. On each negative pulse, CR45 discharges C92. This keeps Q10 off and "Sweep OK" high. If the horizontal sweep stops, Q10 will be turned on through R107 and "Sweep OK" will be pulled low.

## Vertical

(See sheet 5 of the SD)

The vertical circuitry is controlled by the vertical half of U10. Timing capacitor C106 is discharged through R139, setting the vertical free running frequency to slightly less than 60 Hz. The "Vertical Sync" terminates the oscillation early, and locks the oscillator up to 60 Hz. The vertical output of U10 controls power IC U8 which drives the vertical yoke. U8 forms a voltage doubler off of the +24V with C109 and CR49 to allow 48V of drive during the vertical retrace. R152 is used to damp the vertical yoke. C116 resonates with the vertical yoke near 60 Hz to make the circuit easy to drive. R151 and R153 sense the current through the yoke.

R145 divides down the waveform from the sense resistors to provide a vertical size adjustment. R149 can be adjusted to send a dc bias current through the yoke to center the picture vertically. A voltage divider formed by R146, R143, and R142 sets the dc operating point at U8-2. C112 is chosen to provide some correction to the top of the screen. A portion of the ramp at the sense resistors is fed back to the oscillator discharging circuitry through R141 and R140 to improve picture linearity.

### VERTICAL SWEEP MONITOR

If the vertical sweep stops, the vertical sweep monitor pulls "Sweep OK" low. The positive edge of each sweep charges C118 through CR48. C118 gradually discharges through 156. Op-amp U9 amplifies the signal for U6B which pulls "Sweep OK" low if its input drops below 1.3V.

### PINCUSHION

The pincushion correction circuit straightens the picture by modulating the inductance that saturable reactor T6 contributes to the horizontal yoke circuit. Op-amp U9 generates a parabolic voltage waveform ("Pincushion", TP29) from the differential voltage across C116. R136 sets the conversion from voltage to current through T6. Changing the current in the vertical side of T6 changes the inductance of the horizontal side of T6, and changes the width of the picture. Connecting jumper W8 shorts the vertical side of T6 and the uncorrected picture is displayed.

(This page intentionally left blank)

# CRT Cathode PC Board (#A2)

(See SD 19168 on page M3-23)

## VIDEO AMPLIFIERS

Three power amplifiers on this PC board invert and amplify the video signals from the graphics PC board from about 2V p-p to about 50V p-p to drive the three cathodes of the CRT. The supply voltages for the amplifiers are +70V regulated by U1, and -5V regulated by U2. As the circuits for each color are identical, only the red circuit will be discussed here.

R18 and R17 terminate the signal from the graphics PC board with 67 ohms. R18 is adjustable to control the size of the signal at the base of Q4, and thus the gain of the amplifier. Q4 is an emitter follower driving Q5. The base-emitter voltages of Q4 and Q5 cancel, leaving the same voltage at Q5-E as is at Q4-B. R21 converts that voltage to a current. R22 and C17 provide a high frequency zero in the amplifier response. Adjusting R24 sets the dc voltage at Q1-C to establish the proper red background intensity for the particular CRT in use. The current through Q5 also flows through Q1, and is turned back into voltage by R6. L1 provides some extra high frequency gain. R7, R8, and arc suppressor VR1 are protection components to channel possible arc current from the cathodes to the arc ground.

## G1 CIRCUIT

Normally Q10 is on, and G1 is biased at about -30V (set by the -120V at CR3 divided by R50 and R58). If the vertical or horizontal sweep stops, "Sweep OK" is pulled low and Q10 is turned off which drops G1 to -120VDC. This turns off the beam current, preventing a non-sweeping beam from burning out phosphors in the CRT. Similarly if "Cathode Bias" drops below the zener voltage of CR1, Q10 turns off, thus protecting against a drastic increase in beam current.

## ADJUSTMENTS

R46 is a high voltage potentiometer used to adjust the convergence of the three colors on the CRT screen. A dual high voltage potentiometer on the mounting bracket controls the focus and overall screen brightness.

(This page intentionally left blank)

# Front Panel PC Board (#A3)

(See SD 17229 on page M3-25 )

## And

# Peripheral/Memory PC Board (#A10)

(See SD 17154 on page M3-43)

These two PC boards function together, therefore they will be described together in this section.

## FRONT PANEL BOARD

The front panel board contains 42 switches connected to an 8x8 matrix of lines from the keyboard decoder on the peripheral memory board. The operation of this controller will be discussed later. Eight of these switches are next to the CRT and are called "soft-keys". This means that the function of each of them is defined by the software, and will change as the operating mode of the instrument is changed.

The front panel board also has 4 LED "active channel" indicators, CR1 through CR4, and the driver transistors, Q1 through Q4. These are also driven by the keyboard decoder chip.

The CRT intensity control is also mounted on the front panel board.

## PERIPHERAL MEMORY BOARD

The peripheral memory board is divided into 7 functional areas.

1. Keyboard decoder and spin knob control.
2. Dynamic RAM control and 512K bytes of dynamic RAM.
3. VME bus interface.
4. 128K bytes of non-volatile RAM.
5. Vectored interrupt control.
6. Sound generation.
7. Private GPIB control.

## Keyboard Decoder and Spin Knob Control

The keyboard decoder and spin knob control circuit is comprised of the 8279 keyboard decoder chip U38, U54-56, U39-41, and U2. The 8279 is clocked at 1.6 MHz by the decade divider U2. It continuously scans the keyboard for a closed key by sequentially pulling the "scan lines" ~SL0-3 low while monitoring the "return lines" ~RL0-7. The scan lines are binary coded, i.e they count from 0 to 15 and then repeat. This is decoded on the front panel by the 1 of 8 decoder, A3U1 into a set of 8 lines that are connected to the columns of switches. If any switch is closed, one of the return lines will be pulled low when one of the decoded scan lines is low. This results in the 8279 interrupting the CPU by IRQ3 through U26 and U62. At the same time, it will send a code to the I/O lines, DB0-7 which corresponds to the column and row that are connected by the closed switch. The front panel spin knob drives a "stepper" motor which produces 50 pulses per revolution. These pulses are encoded to cause the 8279 to respond as though a set of keys have been pressed. This is accomplished as follows:

The small voltages generated by the two sets of coils in the stepper motor are amplified and clipped by U55A/B. These pulses are then shaped by U54A/B and applied to the PAL U56. The PAL produces a pulse on pin 18 for each input pulse. The first of these starts the "count in progress" timer, U41A which produces a logic high on U56-6 for about 70 ms. During this time, the pulses are counted by U40 binary counter. At the end of the count interval, the result is decoded by U39 and causes one of the "return lines" to be low. The CTRL line is also low at that time by the action of U41B and held for about 70 ms. The CTRL line low is the condition that informs the 8279 that the action is due to the spin knob.

The PAL also controls the shift line which tells the CPU which direction the knob is being rotated. Notice that the faster the spin knob is rotated, the more pulses will be generated during the 70 ms interval generated by U41A. This will be encoded as a speed of 0 to 8 by the action of the decoder, U39. Thus, by the action of this circuit, we have generated a "pseudo keystroke" that contains speed and direction information to be processed by the CPU.

## Dynamic RAM Control

The dynamic RAM (DRAM) control is implemented by the TMS 4500A DRAM controller chip, U31 and several additional gates and latches. The DRAMS, U13-18, U32-37, U49-52 are addressed by row and column, and must have the data rewritten (refreshed) periodically. The TMS4500A generates these signals as well

as the row and column address strobes ~CAS and ~RAS0/~RAS1 from the CPU address lines A1-13. The 4464 DRAMs are 64K by 4 bits or 256K bits each. There are 16 of them which makes a total of 512K bytes.

## VME Bus Interface

VME bus interface is provided by U62-68, U22-24, U57-60, U3-4, U42, U43, U45, U48.

## Non-Volatile RAM

Non volatile RAM (NVRAM) control includes U44, U48A/B and U7-10. The RAMs are 43256's which are 256K bits configured as 32K by 8 bits. Four of them makes a total of 128K bytes. It is operated continuously by using a 3.6 volt lithium battery to provide the power when the the line power is off. The cell is mounted in a carrier at the front of the analog card cage.

The memory is configured as two 64K byte banks. U44 is used to select the bank as well as preventing access to the memory when operating on battery by disabling the chip select gate if ~AC FAIL is true.

## Vector Interrupt Control

Vectored interrupt control is provided by PAL U61 controlling the demultiplexer U5 and the decoder U6. S1 is set with positions 1,3 & 5 closed to provide the base address of the vectoring process.

## Sound Generation

The sounds are generated by a special synthesizer chip, U53 which has 3 outputs that are summed in the power amplifier, Q1-2. The output is controlled in both frequency and amplitude in the synthesizer chip. Thus it is possible to generate a wide range of sounds such as the click heard upon pressing a front panel button to the chime sound when a long term process completes.

## Private GPIB Control

The private GPIB control is provided by the TMS9914, U19, which is buffered by U20-21. It is used to control specific sources and printer/ plotters.

(This page intentionally left blank)

# Calibrator PC Board (#A5)

(See Figure M1-2 on page M1-23 and SD 17170 on page M3-31)

## INTRODUCTION

The heart of the 8003 Scalar Analyzer is a patented calibrator system that allows the power sensors to be calibrated against an internal thermistor power standard (see Figure M1-3, below). In contrast to the conventional fixed-level calibrators, the 8003 calibrator produces a range of power levels over a 50 dB dynamic range to an accuracy of a few thousandths of a dB.

The thermistor is mounted in a self-balancing bridge configuration using DC substitution in the bridge. In this arrangement, the thermistor is maintained at a fixed operating point and the DC power in the thermistor, $P_{DC}$, is related to the RF power, $P_{RF}$, by the simple relationship

$$P_{DC} + P_{RF} = P_{ambient} = \text{constant}$$

The constant, $P_{ambient}$, is found by turning the RF power off and measuring the ambient voltage, $V_{ambient}$, to which the self-balancing bridge settles. The advantage of this approach is that the linearity of the thermistor-leveled oscillator is limited only by the accuracy with which DC voltages can be measured and the stability of the RF calibrator. To ensure exceptional stability, the thermistor assembly is enclosed in a temperature-stabilized environment, and a low drift sampling circuit is used to hold the ambient bridge volt-

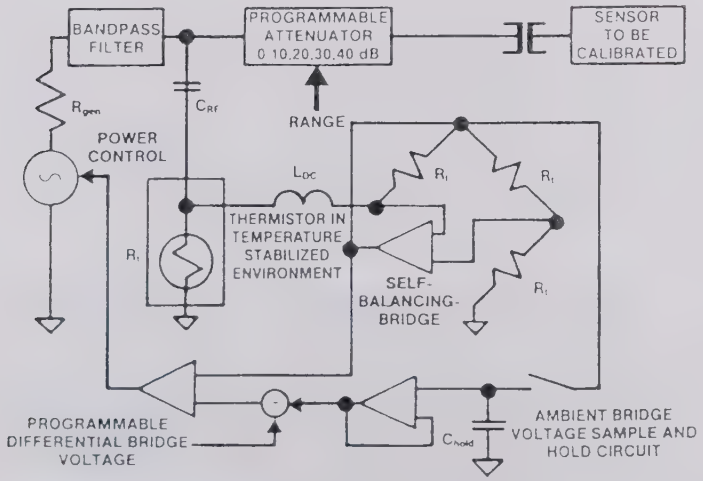



*Figure M1-3. Calibrator Internal Power Standard Configuration*

age. The RF power can then be programmed by controlling a difference voltage, δV, at the summing node. The power is related to this voltage by

$$P_{RF} = \frac{V_{ambient}\ \delta V}{R_1} - \frac{\delta V^2}{2R_1}$$

This permits the RF power to be precisely controlled over a dynamic range of about 12 to 15 dB. The dynamic range is extended using a switched attenuator, the properties of which are determined using the thermistor-leveled oscillator itself. The effective attenuation (including all mismatch effects) of each attenuator relative to the next is measured by finding a pair of powers, one for each attenuator, that produces identical signals from the sensor under test. Because the sensor under test is used at a fixed operating point, no knowledge of its detection law is required.

## GENERAL

The operation of the various circuitry functions of the Calibrator PC Board can be understood more easily if the circuits are discussed individually. The 11 functional sections of this board include the following:

1. The 50 MHz oscillator, Q1, and its current control circuit consisting of U5B, Q2, and U9C.

2. The RF output circuit consisting of the low pass filter, the stepped attenuator and the connector and cable to the front panel of the 8003.

3. The oven that maintains the control thermistor at a constant 60°C which is located on the small board attached to the bottom of the heater transistor, A1Q1. The board has two thermistors, RT1 and RT2, and A5Q6, the control transistor.

4. The thermistor bridge, used to measure the RF power by DC substitution, consisting of A1RT1, U11, Q3.

5. The track and hold circuit that remembers the ambient bridge voltage, using U9A & B and U7A.

6. The 14 bit DAC and reference supply used to measure the ambient bridge voltage and control the RF output level, made up of U1, U2, U3A & B, U4, U5A, U6, U8, U10 and U18A.

7. The correction thermistor circuit used to measure the tempera-

ture of the PIN diode attenuator so that a correction for the temperature dependant loss of the diodes can be corrected, consisting of RT2 and U5D.

8. Calibrator NV (Non-Volatile) RAM control circuit, U15E, U20.

9. Sensor NVRAM control circuit, Q4, Q5, U16, U17D.

10. Sensor interrupt control circuit, U14C, U15E, U17A, U18B/C/D, U19.

11. The digital control circuit consisting of U13, U14A/B/D, U15A/B/C/D, U17B/C.

## 50 MHz OSCILLATOR

The first section of the Calibrator PC Board circuitry, consists of a a colpits oscillator circuit with a controllable power output. The output power is measured by the thermistor bridge and set by varying the DC current through Q1. This current is supplied by a voltage to current converter circuit consisting of U5B, Q2, and U10. The power generated by Q1 is nearly linearly related to the current through it. Thus, the voltage from U10-6 that is converted to current by U5B and Q2 is linearly related to the RF power generated. When the calibrator is set for 0 dBm, the voltage at U10-6 is near 0 volts.

## RF OUTPUT

The 50 MHz oscillator output is capacity coupled to the low pass filter, L2, L3, L9, and associated capacitors. The resultant harmonic-free RF is applied to the switched PIN attenuator, CR12 - 18, and associated resistors and control amplifiers V12 and U5C. The first section is 10 dB, the output section is 20 dB, and a resistor between sections adds another 10 dB. Thus, the output power can be programmed from +20 to -30 dBm.

## OVEN

The measuring thermistor is maintained at a constant 60°C by being mounted on the heater transistor, A1Q1, which is driven from the sensing thermistor A1RT2 by way of the current amplifier, Q6. A1RT2 is mounted very close to A1RT1 so that both are maintained at the same temperature. When A1RT2 gets to a temperature of 60°C, the voltage across it is just enough to maintain drive to the heater. This condition will be maintained regardless of the ambient temperature.

## THERMISTOR BRIDGE

A1RT1 is connected in a self-balancing bridge circuit which will deliver just enough power to the thermistor to keep it at 500 ohms. Thus if part of the power delivered to it is from the RF generated by the oscillator and the rest is from the DC current of the bridge, then by reducing the amount of DC power, the circuit will increase the drive to the oscillator as needed to keep the total power in A1 RT1 constant. It is only necessary to measure the amount of DC power reduction to know the amount of RF power present. In this way we can establish a precisely known RF output level.

## TRACK & HOLD AND DAC

In order to know how much power is being added by the oscillator, it is necessary to measure the power delivered to the thermistor with no RF present. This is done by turning off the oscillator power by closing switch U9C, and then measuring the voltage out of the control bridge. This is known as the ambient bridge voltage. To make this measurement, the following conditions are established: U9A and U9B switches open, U3A & D switches closed. Then by using the DAC, U6, a successive approximation measurement of the voltage is made. Note that the output of the DAC is connected to one input of U10 and the bridge is connected to the other. Thus, it becomes a comparator that will make it possible for the computer to tell when the output voltage of the DAC is greater than the bridge voltage and so to complete the successive approximation. Once this is done, the DAC is set for 0V output, U3A is opened, U3B is closed, U9A & B are closed and the track and hold capacitor, C6 will charge up to the voltage which represents the zero RF power condition of the bridge. When the oscillator is turned on by U9C, then the sampling switch, U9A, will open and allow C6 to supply this "RF off" condition to the measuring circuit. Any voltage from the DAC will now reduce the amount of DC power being delivered to the thermistor bridge, and the control circuit will add just enough current to the oscillator to cause its output to add back that much RF power into the bridge.

## CORRECTION THERMISTOR CIRCUIT

The compensation thermistor is mounted near CR17 to sense the temperature of the 20 dB attenuator section that is used to produce the 0 dBm output which is the only absolute power specified. All other power levels are measured by the software relative to 0 dBm.

# Analog PC Board (#A6)

(See Figure M1-4 on page M1-31 and SD 17289 on page M3-35)

## GENERAL

The analog board contains circuits that provide 7 different functions. These circuits include the following:

A. The detector amplifier circuits, including the input multiplexer and modulator controlled by U10A and U33A. The amplifier has 4 stages with selectable gains. The power sensors are connected to the modulator which is in an enclosed module mounted on the front panel. The signal is then connected to the multiplexer, U29 on the analog board, and then to the input of the first amplifier stage which consists of U31, U32, and U34. The gain of this stage can be set to 512, 64, or 1 by switches U30 and U27A/B. The second stage, U23A, has a gain of 1 or 8 selected by switches U27C/D. The third stage is a low pass active filter, U23C, and has a gain of 1 or 8 selected by switch U20A/D and part of the PAL U33B. Stage four is also a low pass active filter, U23D, with a gain of 8 connected by switches U20C/B.

B. The autoranging control which consists of dual comparator U25, reference supply U28D, comparators U25C/D combined with data latch switches U34A/B , multiple latch U2, PAL U9 and gates U1 and U3D.

C. The amplifier offset supplies which include the dual 8 bit DAC U7, the coarse and fine amplifier and summing amplifier U28A/B/C, and the on/off switch U26C.

D. The analog to digital converter, U8, with its reference output buffered by U22, and the input track and hold U16.

E. The sensor temperature and test function switches U26A/B/D, U14A/B/C/D, and times two amplifier U23B.

F. The digital control interface consisting of I/O buffers U12 and U13, address decoding PAL U11, and PPI U5.

## DETECTOR AMPLIFIERS

The detector amplifiers, autoranging circuits, and the offset supplies combine to provide the required gain to the signal detected by the power sensor. This signal can range from less than 100 nV

to greater than 5 volts. The function is accomplished by automatically selecting a gain from 1 to 262,144. The autoranging circuits will increase the gain starting at the input stages in order to preserve an optimum noise figure. The gains are increased by factors of 8 each time. At high levels, above 1.2 volts input, the gain is set to 1. As the level of the signal decreases, the gain will increase as needed to maintain greater than 1.2 volts at the DAC. The gain increases from unity as follows:

For a gain of 8, stage 2 increases to a gain of 8. For a gain of 64, stage 2 drops to a gain of 1 and stage 1 increases to a gain of 64. For a gain of 512, stage one will increase to a gain of 512. For a gain of 4096, stage 2 again increases to a gain of 8. For a total gain of 32,768 stage 3 will increase to a gain of 8. For a total gain of 262,144 stage 4 will be included. All other combinations of stage gain are locked out by the autoranging circuit.

Note that one filter is always present, stage 3. It has a cutoff frequency of about 20 KHz. In order to prevent the transient generated by the modulator from saturating the filter with the attendant long recovery time, the gain switches for this stage are controlled by a PAL which has as one of its inputs a "deglitch" pulse which is generated in software. During this interval, about 0 .5 msec, both of the input switches of stage 3 are open. Modulation (or chopping) only happens during CW measurements at very low levels (below about -37 dBm), and is accomplished by reading the input voltage while connected normally and then again while inverted. This is done at about 85 Hz, and has the effect of removing any offsets that are constant over that interval of time. The process is controlled by signals generated by the operating system.and processed by PAL U33A.

The second filter has a cutoff frequency of about 10 KHz and when combined with the first filter, gives a cutoff frequency of about 9 KHz. This last filter is only used when stage 4 is used, below about -45 dBm.

## Amplifier Offset Supplies

The amplifier offset supplies provide an output offset for the input stage when measuring very small voltages. The DAC used to measure the amplifier output can only read positive voltage. Therefore, it is necessary to force the amplifier to produce only positive output for any valid input voltage. Since the input is measured in both normal and inverted mode, the offset supply is used to set the amplifier output to about one half of the full scale range, or about 5 volts, with no input signal. This is only needed when the gain is

more than 4096 since that is the only condition under which chopping is employed.

The circuit uses two 8 bit DAC's. The coarse DAC has a range of ± 2.5 volts at the output of the summing amplifier and the fine DAC has a range of ± 25 mV. Therefore the full range of the fine DAC covers about 2.5 bits of the coarse DAC. The result of this is that the voltage can be set to a resolution of about .195 mV with a full scale value of 5 volts or about .04%. The operating system sets the voltage at the output of the summing amplifier by measuring its effect on the output of the detector amplifier with no signal present. After the offset is adjusted, the operating system then mea-sures the voltage at the output of the amplifier string for all 7 gains and makes a table of values to be subtracted from any signal that is measured. This process can be repeated at any time by executing a SENSOR ZERO from the CAL menu.

## A TO D CONVERSION

All of the voltages on the analog board that are measured by the program are digitized by the 14 bit ADC, U8. The 'STS' output of U8 goes high during conversion and is low at all other times. This voltage is used to control the track and hold amplifier, U16. Thus when U8 receives a 'convert' signal, the input to U16 is disconnected and the output voltage is derived from the hold capacitor, C1. The voltage divider that produces 2.7 volts on pin 8 of U16 causes the sense of the signal at pin 7 to be reversed so that a logic high on pin 7 is now a hold signal.

## TEMPERATURE SENSING

Each power sensor has a thermistor in it that measures the temperature of the sensor body in order to correct for the characteristics of the sensor diode. The thermistor is connected to the +15 volt supply through a 100K resistor. This produces a voltage between about 0.4 and 4 volts that is measured by the ADC by way of switches U26A/B/D and amplifier U23B.

Also included in this part of the circuit is a set of dividers and switches that allow the unit to measure some of its voltages to determine if it is working properly. These include R98 and R99 which measure the difference between the two power supplies. Since it is very unlikely that a failure of either or both of these supplies will produce the same difference as normal operation, one measurement will suffice. The values of resistance are different so that the result will always be positive, a necessary restriction. The actual difference for normal operation is 1 volt at the output of the

times two amplifier. Another set of resistors, R53/54 form a 2:1 divider across the 5 volt supply. The result should be 5 volts out of the times two amplifier. The third function is more complicated. It consists of switch U14A and divider R102/103 between the output of the offset summing amplifier and the +10 volt reference supply. The normal range of voltage at the output of the times two amplifier is 1 to 8.6 volts. This is used to check the offset supplies.

## DIGITAL CONTROL INTERFACE

The digital control circuit consists of an address decode PAL and some buffers and tranceivers to allow the CPU to control the functions of the analog board.

# Graphics PC Board (#A11)

(See Figure M1-5 on page M1-39 and SD 16923 on page M3-49)

## GENERAL

The Graphics PC Board provides the timing and RGB analog signals to drive the CRT display. It also stores and modifies the data that represents the picture.

## GRAPHICS CONTROLLER

(Sheet 1 of the SD)

U44, an NEC 7720A graphics controller, is the heart of the circuitry's operation. It generates the vertical and horizontal synchronization signals for the CRT display. U63, U58, U49, U55A, U59, U52, U56A, and U56B form the interface between U44 and the VME bus. Y1 provides the 28.7539 MHz pixel clock. Binary counter U1 divides the pixel clock by 2, 4, and 8 to provide timing signals. The pixel clock divided by 8 is the 2XWCLK that runs the graphics processor. (See Figure M1-6 on the next page for a diagram of vertical and horizontal timing.)

The Address Latch Enable (ALE) signal from U44 becomes the Row Address Strobe (RAS) signal. U57, U53A, and U53B generate the Column Address Strobe (CAS) signal and the Row Select (ROWSEL) signal delayed from ALE. The Video Shift Register Load (VSRLD) signal is generated by U8A and U55B once every sixteen pixel clocks during the display cycles. The Display Buffer Input (DBIN) signal comes from U44. The Transceiver Enable (ENTRANS) signal is made false by U54A and U53D only when video data is being loaded into the shift registers during the display cycles. Write Video (WRV) is true for writing to the memory. Octal latch U60 stores the three high order address bits, AD15 and A16 - 17, through the command cycle as AA15 - 17. U17 'ands' the pixel data with the blanking signal. U24 clocks out the pixel data.

## COLOR PLANES

(Sheets 2 & 3 of the SD)

Sheet 2 of the SD shows the frame buffers for plane 1 (red) and plane 2 (green). As the planes are identical, only one (plane 1) will be described here.

Four 64K by 4 DRAMs, U4, U11, U20, and U27, contain the data that represents the red portion of the currently displayed picture. To display the next 16 bits of the image, the graphics processor

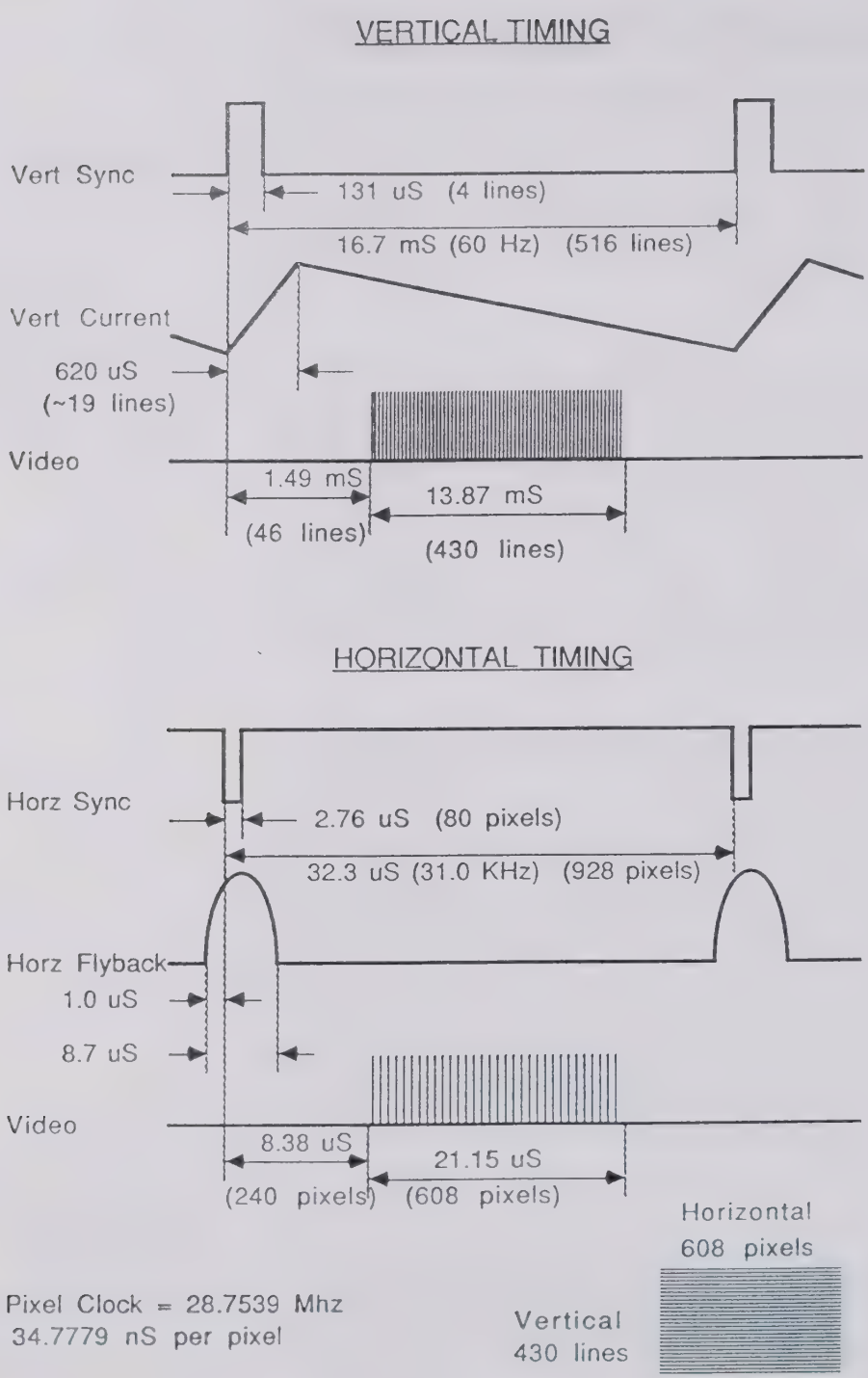



*Figure M1-6. Graphics Controller Vertical and Horizontal Timing Diagram*

sends the next word address on the AD0 - 15 lines. Multiplexers U15 and U16 first select the eight row address bits which are clocked into the DRAMs by the RAS signal. Then the multiplexers select the 8 column address bits which are clocked into the DRAMs by the CAS signal. The sixteen data bits, four from each DRAM, are then loaded in parallel into shift registers U9 and U25. The data is then clocked out serially at the pixel clock rate. While this data is being sent out, the graphics processor is repeating the cycle for the next 16 bits of the picture. In displaying, all four planes are active at once to show a full color picture. In read-modify-write cycles, the graphics processor reads from and writes to only one plane at a time. Transceivers U36 and U37 are activated when reading or writing in plane 1. Demultiplexor U50A sends WRV to only the active plane (based on AA15 - 17) for writing. Similarly, U50B sends DBIN to only the active plane for reading. Jumper pins W1 and W2 select the memory chip size. Since we use 256K chips, W1 is jumpered.

Sheet 3 of the SD shows the RAM, transceivers, and shift registers that form plane 3 (blue) and plane 4 (graticule).

## RGB OUTPUT DESCRIPTION

(Sheet 4 of the SD)

Flip flops U61 and U62 and associated resistor packs set the amplitude of the Red, Green, and Blue signals. For example if U61's outputs, Q0 and Q1, are both high, this sets the amplitude of the Red signal caused by plane 1 to be the maximum by pulling U33-3 up through both RP3-1 and RP4-1 versus RP7 pulling down. The four combinations of Q0 and Q1 provide four levels of intensity (only two of which are used). The state of the flip flops is set by the CPU through part of the VME interface on sheet 1. As the voltage of INTENADJ is changed by a potentiometer on the bezel, resistor pack RP8 provides an intensity adjustment for all colors.

The data from the four planes is converted into Red, Green, and Blue signals by three voltage to current amplifiers. As the amplifiers and related circuits are the same for each color, only the red circuit will be described here.

The voltage at transistor array U33-3 sets the current through R7. When plane 1 is low (pixel), R7's current is drawn through Q3. Q7 is a current amplifier which delivers 3 times the current in R7 to the Cathode Driver PC Board. The resistors terminating the line there convert the current back to voltage. CR3 clamps the output at about 2.2V.

Plane 4, the graticule plane, is fed to all three amplifiers. If the graticule is defined to have red in it, U33-11 will be biased high. Then, when graticule pixels are indicated by lows at U33-9, R4's current will be sent into Q3 along with R7's current. Thus, the RED signal would be an analog 'OR' of plane 1 and plane 4.

# CPU PC Board (#A12)

(See SD 16984 on page M3-57)

## GENERAL

The CPU board circuitry includes 6 functional areas.

A. The MPU U30, 12 PROMS U1-6 & U14-19, the system clock Y1, U12B and U13B.

B. The interrupt control U39, U40A/D/E/F and PAL (Programmable Array Logic) U22.

C. VME bus buffers and tranceivers U41-46, VME bus arbitration PAL U22, U20A/B, U25, U31D/E, U21, U9, U8B and U13C. (VME = A generic bus style)

D. Real time clock U24, U8A, U10A, U13A and U38A/B.

E. Serial port U29, U34A/B, U33A/B/C, U10C, U11, U12 and U21.

F. System GPIB U27, U37B/C/D, U35 and U36.

G. System Reset U7, U8C

## MICRO-PROCESSOR

The Microprocessor unit (MPU) is a type 68000, 32 bit controller which uses a program stored in the twelve type 27512 EPROMS, U1 to U6 and U14 to U19. The 8 MHz clock signal is derived from the 16 MHz crystal, Y1, and the divide by 8 section of U12. U13B buffers the crystal oscillator for the remainder of the requirements of the "system clock". The type 27512 EPROMS have 16 address lines. Jumpers W1-W6 are used to properly connect the upper address lines to make it possible to use different size memory chips. For the 27512, the jumpers are installed at B and C. The EPROMS are split into "banks" and pairs by the use of signals ~MEM 0-3 and ~BANK derived from the address decode PAL U23.

## INTERRUPT CONTROL

There are several different conditions that can interrupt the MPU in order to receive immediate service. These hardware conditions

are processed by the priority encoder U39 in conjunction with U40 A/D/E/F and part of the PAL U22.

## VME BUS

The VME bus is isolated from the CPU board circuits by the U45 and U46 tranceivers for the data lines, the U41-43 buffers for the address lines, and U44 for the control lines. VME System Controller functions are accomplished by the use of several counter and combiner circuits. Part of U21 combined with U20A divide a 9.6 kHz signal by both 2 and 32 to provide 4.8 kHz and 300 Hz to U9. U9A will produce a bus error signal if the time between address strobes exceeds 40 msec. U9B will provide a system reset pulse 2.5 ms after receipt of an ac line failure. Bus request/bus grant control is handled by the U25 shift register driven from the 16 MHz system clock, combined with U31D/E inverters and part of PAL U22.

## REAL TIME CLOCK

The real time clock consists of the clock chip U24, and its associated crystal Y2 which operates at 32 kHz. The clock is controlled directly from the MPU I/O lines by using U10A, U13A and U38A/B as decoding devices. This clock is operated when the power is off by using a battery backup supply. In order to keep the power drain low when operating from the battery, the chip enable line is held off (high) by resistor R7 and held on (low) by U8A when the line powered 5 volts is present.

## RS232 SERIAL PORT

The RS232 serial port is implemented by asyncronous communications interface adapter (ACIA) U29. The RS232 levels are converted to/from TTL levels by the use of U34A/B and U33A/B/C. The baud rate clock is derived from the system clock by divider string U11, the divide by 2 section of U12, and the divide by 2, 4 and 8 part of U21. The 16 MHz is divided down to 4 MHz by U12. The 4 MHz is used to drive the system GPIB chip and the baud rate divider. U11 and U10 divides by 13 to produce a 307.7 kHz signal which is further divided by 2 in U12. This 153 kHz signal is then used directly through jumper W8A, or it is further divided by 2, 4, or 8 in U21 and connected by jumpers W8B/C/D, respectively, to U29. In this way we can select 1200, 2400, 4800 or 9600 baud serial operation. The unit is shipped with W8A connected to provide 9600 baud operation.

# Rear Panel PC Board (#A13)

(See Figure M1-7 on page M1-49 and SD 19143 on page M3-61)

## GENERAL

The rear panel circuit is used to convert digital output signals to analog voltages, to convert analog input voltages to digital words, and to accept two digital on/off control signals.

## D TO A CONVERSION

(The DAC OUT function has not yet been implemented)

The first (D to A) function uses a 14 bit DAC, U7, in conjunction with U8 to produce a 0 to 10V signal which is buffered by U9 and connected to the rear panel connector labeled DAC OUT. This is intended to be an accurate voltage, and therefore is calibrated using R7. There is a second set of analog output voltages labeled BIAS OUTPUT and AC MOD OUTPUT which use a dual 12 bit DAC, U16, and a set of high powered buffers, U18A&B, driven from summing amplifiers U17C&D. The summing amplifiers are used to eliminate the offset voltage of the output stage which is connected in a unity gain follower configuration. Since the output current can exceed 150 mA, isolation resistors cannot be used and PTC fuses are used instead. The output of the dual DAC is 0 to +10V, The Bias and AC Mod outputs are rated from -10V to +10V so it is necessary to use a gain of 2 in the summing amplifiers and offset the output to +10V by the use of R53 and R65.

## A TO D CONVERSION

(This function has not yet been implemented)

The second (A to D) function is to allow the input of analog voltages which are labeled SWEEP IN and V prop F IN. The SWEEP IN function is at a fixed gain, and uses U15A and track and hold, U13. This converts 0 to +10.75V to -10 to +10V at the ADC, U6. The second, V prop F IN, function can be set to a gain of 0.5 or 2, and is used to properly scale the voltage proportional to frequency input. It consists of U15B, and associated circuits U14 track and hold and gain switches U12C&D.

## BLANKING INPUT

The BLANKING INPUT clocks the latches U2A&B to produce a CPU interrupt on each edge of the input. The latch outputs are combined in U4B, and inverted by U4C to generate the "source interrupt" signal labeled SINT.

## INPUT 1

INPUT 1 is connected directly to the PPI, U1, and does not produce an interrupt.

## DIGITAL ADDRESS DECODING

The digital address decoding for the rear panel is done in U3, a programmable array.

# Modulator PC Board (#A14A1)

(See SD 19944 on page M3-65)

The modulator is a set of switches that are used to provide a software chopping function while making low level CW measurements.

When the signal applied to a sensor is below about -50 dBm, the software changes from a simple measurement of the DC voltage at the output of the sensor to a series of measurements alternating between direct and inverted connection of the sensor output. The results are then added and averaged. This chopping action occurs at about 90 Hz. The quad analog switches, A4U1 to A4U4, are used as software controlled double-pole, double-throw reversing switches. When measuring power levels above about -50 dBm, the switches are locked in the non-inverting condition.

## NOTE

Since it is sometimes the case that the Operating manual and Maintenance (Service) manual for an instrument will be used in separate locations (Operating manual with a user and Maintenance manual to a Cal Lab for instance), the Performance Verification Tests given in Chapter 5 of the Model 8003 Operating Manual have been directly reproduced in the section that follows. The purpose of this is to allow a Calibration Technician to perform initial tests on the instrument to determine the state of its health prior to doing a calibration routine, or at any desired time.

# CHAPTER 5

*(Extracted directly from the Model 8003 Operating Manual)*

# SPECIFICATION AND PERFORMANCE VERIFICATION TESTS

## GENERAL

Information is this section is useful for periodic evaluation of the Model 8003 Precision Scalar Analyzer and its power sensors. These tests can also be used for incoming inspection testing when the instrument is first received, if required.

If the 8003 has not previously been used, Chapter 2 of the Operating Manual should be reviewed to ensure that the instructions covering power requirements and GPIB address selection, for example, have been complied with before the instrument is turned on. Prior to starting the following procedures, the instrument should be allowed to warm up for at least 30 minutes to assure maximum stability during testing.

The Specification Test for the Calibrator Output Power Reference Level given in this section is valid for an ambient temperature range between +15°C and +35°C.

The instrument plus power sensor linearity test is valid when the sensor has been calibrated using the front panel calibrator at a temperature between 0°C and +50°C, and if operating within ± 5°C of that calibration temperature.

It is recommended that the verification be done in the order described since some of the steps use the configuration from a previous step.

As an aid to executing the steps presented, keystroke sequences used on the 8003 are shown in the outer column of the page. Also, as in the preceding chapters, a distinction is made between the front panel "hardkeys" and the CRT adjacent "softkeys". The "hardkeys" are shown in **BOLD**, for example, [**CONFIG**], and the softkeys are shown in *ITALICS*, for example, [*SENSORS AC/DC*].

For information on how to calibrate the 8003, refer to the Maintenance Chapter of this manual'

# EQUIPMENT REQUIRED

| Description | Representative Model | Key Characteristics |
|---|---|---|
| Microwave Sweeper | Wavetek 8910 Series | Model 8003 Supported |
| Oscilloscope | Tektronix 2235 | BW = > 100kHz; Sens = > 2V/DIV |
| CW Thermistor Power Meter | HP 432A | $V_{RF}$ and $V_{COMP}$ available externally |
| Thermistor Mount | HP478A-H75 | ≤ 1.07 VSWR @ 50 MHz (30 dB return loss) Accuracy ± 0.5% @ 50 MHz |
| Digital Voltmeter (DVM) | Datron 1081 | ± 0.05% accuracy & 1 µV resolution |
| Directional Coupler, 10 dB | Mini Circuits ZFDC -10 -1 10 dB | ≤ 1.15 SWR @ 50 MHz |
| Step Attenuator, 0 to 90 dB in 10 dB increments | Weinshel Model AC 118A-90-33 | ≤ 1.15 SWR @ 50 MHz ± 0.1 dB attenuation |
| RF Source (Signal Generator) (High Power) | Wavetek Model 2510A Option XP | > 100mW @ 50 MHz |
| Low Pass Filter | Integrated Microwave Model 904 881 | > 50 dB Attenuation @ 100 MHz |
| GPIB Controller | HP Vectra Family | |
| Printer | HP Laserjet Series II | RS-232 Interface & Command Set |
| High Resolution Color Display Monitor (Required for 8003 Option 02 only) | NEC Multisync | 31 kHz Line Rate 60 Hz Field Rate RGB Input |

**Performance Verification Test Data recording sheets are located starting on page 5-13. These sheets can be copied, and the copies used for recording test results each time Specification and Performance Verification testing is performed on this instrument.**

# TEST PROCEDURES

## Calibrator Output Power Reference Level

The Calibrator Output power reference is factory adjusted to 1mW ±0.7%. To achieve this accuracy, Wavetek uses a precision measurement system with accuracy to ±0.5% (traceable to the National Bureau of Standards), and allows for a transfer error of ±0.2% for a total of ± 0.7%. If an equivalent measurement system is used for verification, the power reference oscillator output can be verified to 1mW ±1.9% (±1.2% accuracy + ± 0.5% verification system error + ± 0.2% transfer error = ± 1.9% maximum error). To ensure maximum accuracy in verifying the Calibrator Output power reference, the following procedure provides step-by-step instructions for using specified test instruments of known capability. If equivalent test instruments are substituted, refer to the Key Characteristics section in the table of Equipment Required on the preceding page.

Figure 5-1, below, can be used as a guide for assembling the test setup.

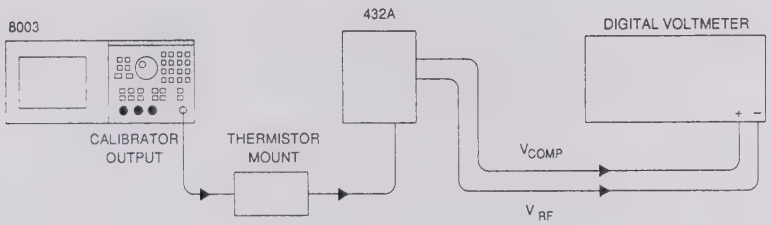



*Figure 5-1. Calibrator Output Power Reference Level Test Setup*

### PROCEDURE

In the following steps, precision power measurements will be made using the 432A Power Meter. For detailed information on using the 432A, please refer to the operating section of the 432A manual.

1. Connect the 432A to the Calibrator Output on the 8003 as shown in Figure 5-1.

2. Turn on all equipment and then wait 30 minutes for the thermistor mount to stabilize before proceding to the next step.

3. Set the 432A RANGE switch to COARSE ZERO, and adjust the front panel COARSE ZERO control to obtain a zero (±2% F. S.) meter indication.

**NOTE: Ensure that the DVM input leads are isolated from chassis ground when performing the next step.**

4. Set the DVM to a range that results in a resolution of 1 μV and connect the positive and negative input, respectively, to the $V_{COMP}$ and $V_{RF}$ connectors on the rear panel of the 432A.

5. Fine zero the 432A on the most sensitive range, then set the 432A range switch to 1 mW.

6. Record the DVM indication as $V_0$.

7. Turn ON the 8003 Calibrator RF power as follows:

[**CONFIG**] [*SERVICE*] [*SET CAL*]

In the "System" section on the front panel of the 8003 is a key labeled **CONFIG**. Press this key and a menu will appear with a softkey labeled *SERVICE*. Press this key and another menu will appear with a softkey labeled *SET CAL*. Press *SET CAL*. Record the reading shown on the DVM as $V_1$.

**NOTE: The $V_1$ reading must be taken within 15 seconds after pressing *SET CAL*. Otherwise, press the *ABORT* softkey and repeat Steps 6 and 7.**

8. Disconnect the DVM negative lead from the $V_{RF}$ connector on the 432A, and reconnect it to the 432A chassis ground. Record the new indication observed on the DVM as $V_{COMP}$.

9. Press the *ABORT* softkey on the 8003.

10. Calculate the Calibrator Output level ($P_{CAL}$) using the following formula:

$$P_{CAL} = \frac{2V_{COMP}(V_1 - V_0) + V_0^2 - V_1^2}{4R\ (\text{CALIBRATION FACTOR})}$$

where:

| | | |
|---|---|---|
| $P_{RF}$ | = | Calibrator Output power reference level |
| $V_{COMP}$ | = | previously recorded value in Step 8 |
| $V_1$ | = | previously recorded value in Step 7 |
| $V_0$ | = | previously recorded value in Step 6 |
| R | = | 200 Ω (assuming HP478A-H75 mount) |
| CALIBRATION FACTOR | = | value for the thermistor mount at 50 MHz (traceable to the National Bureau of Standards) |

11. Verify that the $P_{CAL}$ is within the following limits:

**1mW ±0.019mW**
(0.981 to 1.019mW)

(For record purposes, the measured value of $P_{CAL}$ can be entered on the Test Data Recording Sheet located on page 5-13.)

## Instrument Plus Power Sensor Linearity

### TEST DESCRIPTION

Connect the test setup as shown in Figure 5-2 on the next page. The linearity will be tested over the range +20 dBm to -60 dBm (CW Mode) and +20 dBm to -50 dBm (Swept Mode). At low power levels, the linearity measurement will include the uncertainty due to the zero set specification. The 8003 and sensor will be verified in both the CW and Swept modes of operation. The procedure should be repeated for each sensor used with the 8003.

Refer to the CW Linearity Data and the Swept Linearity Data sections of the Performance Verification Data recording sheets located on pages 5-13 through 5-16. These sections facilitate the collection of data for the CW and Swept power linearity tests. The tolerance is already entered in each section for the various steps, and includes an allowance for specified zero set errors at low power levels.

**To ensure accurate and repeatable measurements, the 432A power meter should be zeroed just before taking each reading that will be used to calculate "P1" in the Power Meter column of the Performance Verification Test Data Sheets on pages 5-13 through 5-16.**

## SETUP PARAMETERS

The following setup parameters should be accomplished prior to performing the Power Linearity test:

A. The 8003 and sensor should be calibrated by following the instructions starting on page 3-18 of Chapter 3 - Operation.

[**DEFINE**] [*CW*]

B. The 8003 is placed in the CW mode by pressing the **DEFINE** key and toggling the *CW/SWEPT* softkey if necessary.

[**DISPLAY**] [*READOUT*]

C. A "Readout" display is obtained by pressing the **DISPLAY** key, and toggling the *GRAPH/READOUT* softkey as required.

[**DISPLAY**] [*UNITS*] [*LINEAR*]

D. Set the 8003 to display linear units of power (mW) by pressing the **DISPLAY** key and selecting the appropriate *UNITS* softkey labels.

[**DISPLAY**] [*AVG*] [**4**] [**ENTER**] [*AVG ON*]

E. The CW Averaging is set to 4 by entering the key sequence shown to the left.

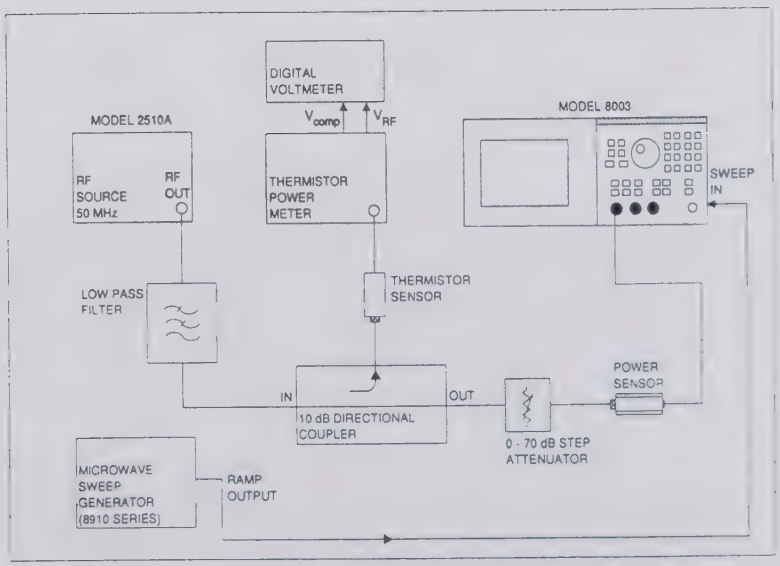



*Figure 5-2. Power Linearity Test Setup*

NOTE 1: Extreme care is required in the following procedure since the accuracy requirements are far greater than normally encountered in calibrating a Scalar Network Analyzer.

NOTE 2: Power readings are determined using the thermistor power meter in the same general way as given in the Power Reference Level test. That is, "$P_1$" and "$P_2$" in the Power Meter reading column of the Performance Verification Test Data Sheet tables are calculated each time for the respective values of $V_{COMP}$, $V_0$, and $V_1$ read on the DVM.

## TEST PROCEDURE

1. Set the step attenuater to 70 dB. Turn the source power output off, and then zero the 8003.

   (The 8003 is zeroed by pressing the **CAL** key located in the "Function" section on the front panel, and then following the softkey label instructions.)

   [**CAL**] [*ZERO SENSOR*] [*SENSOR A/B/C ZERO*]

2. Set the step attenuator to 0 dB after the 8003 chimes to signal the completion of the zeroing process.

3. Set the power output of the RF source so that the thermistor power meter indicates 1.00 mW ± 0.025 mW.

4. Record the calculated power meter reading and the displayed 8003 reading in the correct columns of the CW Linearity Data recording sheet on page 5-13.

5. Set the power output of the RF source so that the thermistor power meter indicates 3.98 mW ± 0.10 mW.

6. Record the new calculated power meter reading and the new displayed 8003 reading as in Step 4, above.

7. Set the power output of the RF Source so that the thermistor power meter indicates 3.98 mW ± 0.10 mW.

8. Record the calculated power meter reading and the displayed 8003 reading as in Step 4, above.

9. Set the power output of the RF Source so that the thermistor power meter indicates 5.01 mW ± 0.13 mW,

10. Record the new calculated power meter reading and the new displayed 8003 reading as in Step 4, above.

11. Repeat using the power meter indications in the Data Recording sheet on page 5-13. Note that the Step Attenuator is used to generate the remaining 70 dB range of 10 dB steps for a total range of 80 dB.

NOTE: Increase the averaging figure to 8 at 60 dB, and to 16 at 70 dB. Repeat Step 1 before performing the 70 dB step.

12. Make the calculations indicated on the CW Linearity Data sheet, and enter the values in the appropriate blank spaces.

[**DEFINE**] [*SWEPT*]

13. Repeat Steps 1 through 11 using the Swept Mode (1 second sweep), and record the results on the Swept Linearity Data recording sheet (page 5-15).

NOTE: In the swept mode it is necessary to calculate the linear power from the dBm reading on the 8003. Also, be sure that the Start and End frequencies are set to 50 MHz.

## Serial Port Check

The following steps are used to confirm that the RS-232 port on the 8003 is functional.

The following are the factory default settings for the communications parameters on the serial port of the 8003:

| | |
|---|---|
| Baud Rate: | 9600 |
| Parity: | N |
| Data Bits: | 8 |
| Stop Bits: | 1 |

If required, the 8003 can support baud rates of 1200, 2400, and 4800 by moving W8 on the Processor PC Board (A12).

[**DISPLAY**] [*GRAPH*]

1. Configure the 8003 to be in the Graph Mode.

2. Connect the RS-232 cable between the Serial Port on the rear of the 8003 and the Serial Port on the Laserjet printer.

[**DISPLAY**] [*PLOT & PRINT*] [*PRINT*] [*LASER PRINT*]

3. Print a graph.

NOTE: Paint Print and Ink Print can only be executed over the GPIB.

## GPIB/System Port Check

The following steps are used to confirm that the GPIB/System port is functional.

[CONFIG] [*GPIB DEVICES*] [**nn**] [ENTER]

1. Set the 8003 to the desired address (default is 4).

2. Connect the GPIB controller to the GPIB/System Port on the rear of the 8003.

3. Send the command:

   *IDN?

   This verb is the standardized COMMON identify query command as defined by IEEE 488.2 1988. When talk addressed after receiving the command, the 8003 will output a string that identifies itself as the 8003 Scalar Network Analyzer.

4. Display the response on the controller. Further information on using the 8003 through the GPIB is given in Chapter 4.

## GPIB/Private Port Check

1. Connect the 8910 Series sweeper system port (or one of the other supported sweepers listed in Chapter 3) to the GPIB/ Private Port on the rear of the 8003.

2. Determine the system port address of the sweeper. On the Wavetek 8910 Series sweepers, this is done as shown to the right.

   [**Local**] [**Shift**] [**Status 2**] (8910 Series keystrokes)

3. Enter the address obtained in Step 2 as the Source Address on the 8003.

   [**CONFIG**] [*GPIB DEVICES*] [*SOURCE ADDRESS*] [**nn**] [**ENTER**]

4. Check that the 8003 recognizes the sweeper by verifying that sweeper dependent softkey selections on the 8003 (such as "Power") are NOT dark blue.

   [**POWER**] [*Softkey labels are green or cyan*]

## Sweep In Connector Check

1. Connect the Sweep Out connection from the sweeper to the Sweep In on the 8003.

2. Configure the 8003 to be in the Graph/Swept Mode.

   [**DISPLAY**] [*GRAPH*] [**DEFINE**] [*SWEPT*]

3. Select a sweep time of 1 second.

   [**SWEEP TIME**] [**1**] [**S**]

[CONFIG] [*CAL SWP RAMP*]

4. Calibrate the Sweep Ramp.

[CH 1] [SCALE] (*Autoscale*]

5. Display Channel 1 and Autoscale.

6. Disconnect, and then connect the BNC cable to the Sweep In connector on the 8003.

7. Observe that the trace is being swept only when the BNC cable is connected.

## AC Mod Output Connector Check

The 8003 AC Modulation Output voltage default values are +5V (AC Modulation off), and a square wave switching between 5V and 0V (AC Modulation on), at a nominal 1 kHz frequency. The 8003 may generate different voltages using values stored in an internal lookup table depending on the sweeper to which it is connected via the GPIB/Private port.

1. Connect the AC Mod Output to the Vertical input on the oscilloscope. Set the oscilloscope as follows:

| | |
|---|---|
| Coupling: | DC |
| Volts/Div: | 2V/Div |
| Time/Div: | 200 µs/Div |
| Triggering: | AC/Auto/Int |

2. Ground the oscilloscope input and center the trace.

[CONFIG] [*SENSORS AC/DC*] [*ALL DC*]

3. Set the 8003 to the DC Mode of operation.

4. Select DC coupling on the oscilloscope, and check that it indicates a positive voltage of 5V.

[CONFIG] [*SENSORS AC/DC*] [*All AC*]

5. Set the 8003 to the AC Mode of operation.

6. Check that the oscilloscope displays a square wave, repetition frequency between 500 Hz and 1.5 kHz, between 0V and +5V.

## Bias Output Connector Check

The following steps are used to confirm that the Bias Output Voltage connector is functional. These steps can be bypassed if it not intended to use this capability for applications such as supplying power to PIN diode attenuators.

NOTE: The Bias Voltage Output is channel dependent, and only on during the sweep time for each channel which has been configured by the user to output a bias voltage.

In the following procedure it is recommended that the 8003 be set to display channel 1 only, and that a sweep time of 1 second be set on the sweeper.

[CH 1] [CH 2] [OFF] [CH3] [OFF] [CH 4] [OFF] [SWEEP TIME] [1] [S]

1. Set the 8003 to be in the Graph/Swept Mode.

[DISPLAY] [*GRAPH*] [DEFINE] [*SWEPT*]

2. Connect the Bias Output Voltage connector on the rear of the 8003 to the vertical input of the oscilloscope. Set the oscilloscope as follows:

   Volts/Div: 5V/Div
   Time/Div: 200 µs/Div
   Triggering: AC/Auto/Int

3. Ground the oscilloscope input and center the trace.

4. Select DC coupling on the oscilloscope.

5. Set the Bias Output Voltage on the 8003 to +10V.

[DEFINE] [*BIAS VOLTAGE*] [1] [0] [S]

6. Check that the trace on the oscilloscope moves up 2 divisions (+10V) from center screen during the sweep, and back to center (0V) on retrace.

7. Set the Bias Voltage Output on the 8003 to -10V.

[DEFINE] [*BIAS VOLTAGE*] [1] [0] [S]

8. Check that the trace on the oscilloscope moves down 2 divisions (-10V) from center screen during the sweep, and back to center (0V) on retrace..

## V ∝ F In Connector Check

Not Presently Used

## DAC Output Connector Check

Not Presently Used

## Floppy disk Port Check

Not Presently Used

## NS200 Port Check

Not Presently Used

## RGB Video Output Connector Check

(8003 Option 02 only)

Connect the 8003 Op 02 RGB Video Output to the High Resolution Color Display Monitor and display a stable color picture that duplicates the display on the 8003.

## SUMMARY

This completes the Specification and Performance Verification Tests for the 8003 Precision Scalar Analyzer and its sensors. If the instrument has performed as described in this chapter, it is correctly calibrated and within specifications.

If the instrument fails to meet any of the criteria defined in the tests, refer to the calibration and/or maintenance sections of the 8003 Maintenance Manual.

# WAVETEK MODEL 8003 PERFORMANCE VERIFICATION TEST DATA SHEET

Date: _____ Model 8003 S/N: _____

Operator: _____ Power Sensor S/N: _____

Test Number: _____ (if required)

## *Calibrator Output Power Reference*

| Minimum | Actual Reading | Maximum |
|---|---|---|
| 0.981 mW | | 1.019 mW |

## *CW Linearity Data* - (+16 dBm to +20 dBm)

| Step Atten Value | Power Set Point | Power Meter Reading (P) | 8003 (DUT) Reading (R) | Reference Power Ratio | 8003 (DUT) Reading Ratio | [1] Linearity Error (%) Linearity Specification | [2] Accumulated Linearity Error |
|---|---|---|---|---|---|---|---|
| 0 dB | 1.00 mW ±0.025mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 3.98 mW ±0.10 mW | P2 = | R2 = | | | ±1% | *Same as Lin. error above* |
| 0 dB | 3.98 mW ±0.10 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 5.01 mW ±0.13 mW | P2 = | R2 = | | | +1% -1.37% | |
| 0 dB | 5.01 mW ±0.13 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 6.31 mW ±0.16 mW | P2 = | R2 = | | | +1% -1.83% | |
| 0 dB | 6.31 mW ±0.16 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 7.94 mW ±0.2 mW | P2 = | R2 = | | | +1% -2.28% | |
| 0 dB | 7.94 mW ±0.2 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | +1% -2.73% | |

(continued on next page)

[1] Linearity Error (%) = ((R1/R2) / (P1/P2) -1) * 100

[2] Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.

## *CW Linearity Data* - (+16 dBm to -60 dBm)

| Step Atten Value | Power Set Point | Power Meter Reading (P) | 8003 (DUT) Reading (R) | Reference Power Ratio | 8003 (DUT) Reading Ratio | [1] Linearity Error (%) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Linearity Specification | [2] Accumulated Linearity Error |
| 0 dB | | | | | | [3] See Below | |
| | | | | | | ±1% | *Same as Lin. error above* |
| 10 dB | 1 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | ±1% | |
| 20 dB | 1 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | ±1% | |
| 30 dB | 1 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | ±1% | |
| 40 dB | 1 mW ±0.025mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25mW | P2 = | R2 = | | | ±1% | |
| 50 dB | 1 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | ±1% | |
| 60 dB (increase avg to 8) | 1 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | ±1.5% | |
| 70 dB (increase avg to 16) | 1 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | ±6% | |

[1] Linearity Error (%) = ((R1/R2) / (P1/P2) -1) * 100
[2] Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.
[3] Use the first CW Linearity error value entered in the +16 dBm to +20 dBm table on page 5-13.

## *Swept Linearity Data* - (+16 dBm to +20 dBm)

| Step Atten Value | Power Set Point | Power Meter Reading (P) | 8003 (DUT) Reading (R) | Reference Power Ratio | 8003 (DUT) Reading Ratio | [1] Linearity Error (%) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Linearity Specification | [2] Accumulated Linearity Error |
| 0 dB | 1.0 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 3.98 mW ±0.10 mW | P2 = | R2 = | | | ±1.4% | *Same as Lin. error above* |
| 0 dB | 3.98 mW ±0.10 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 1.00 mW ±0.025 mW | P2 = | R2 = | | | +1.4% -1.83% | |
| 0 dB | 5.01 mW ±0.13 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 6.31 mW ±0.16 mW | P2 = | R2 = | | | +1.4% -2.28% | |
| 0 dB | 6.31 mW ±0.16 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 7.94 mW ±0.2 mW | P2 = | R2 = | | | +1.40% -2.73% | |
| 0 dB | 7.94 mW ±0.2 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | +1.40% -3.17% | |

(continued on next page)

[1] Linearity Error (%) = ((R1/R2) / (P1/P2) -1) * 100
[2] Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.

## *Swept Linearity Data* - (+16 dBm to -50 dBm)

| Step Atten Value | Power Set Point | Power Meter Reading (P) | 8003 (DUT) Reading (R) | Reference Power Ratio | 8003 (DUT) Reading Ratio | [1] Linearity Error (%) | |
|---|---|---|---|---|---|---|---|
| | | | | | | Linearity Specification | [2] Accumulated Linearity Error |
| 0 dB | | | | | | [3] See Below | |
| | | | | | | ±1.4% | *Same as Lin. error above* |
| 10 dB | 1 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | ±1.4% | |
| 20 dB | 1 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | ±1.4% | |
| 30 dB | 1 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | ±1.4% | |
| 40 dB | 1 mW ±0.025mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25mW | P2 = | R2 = | | | ±1.5% | |
| 50 dB | 1 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | ±2.4% | |
| 60 dB (increase avg to 8) | 1 mW ±0.025 mW | P1 = | R1 = | P1/P2 = | R1/R2 = | | |
| | 10 mW ±0.25 mW | P2 = | R2 = | | | ±11.4% | |

[1] Linearity Error (%) = ((R1/R2) / (P1/P2) -1) * 100
[2] Accumulated error is the sum of the current dB segment linearity error plus the previous accumulated error.
[3] Use the first Swept Linearity error value entered in the +16 dBm to +20 dBm table on page 5-15.

(Further copies of the Performance Verification Test Data Sheets can be obtained from Wavetek or your local Wavetek representative.)

# EQUIPMENT REQUIRED

(All test equipment must be within calibration limits as specified in the instruction manual or calibration procedures pertaining to the particular piece of equipment.)

| Description | Representative Model | Key Characteristics |
|---|---|---|
| Microwave Sweeper | Wavetek 8910 Series | Model 8003 Supported |
| Oscilloscope | Tektronix 2235 | BW = >100 kHz; Sens = >2V/DIV |
| CW Thermistor Power Meter | HP432A/B | $V_{RF}$ & $V_{COMP}$ available externally |
| Thermistor Mount | HP478A-H75 | ≤ 1.07 VSWR @ 50 MHz<br>(30 dB Return Loss)<br>Accuracy ± 0.5% @ 50 MHz |
| Digital Voltmeter (DVM) | Datron 1081 | ± 0.05% accuracy & 1μV resolution |
| GPIB Controller | HP Vectra Family | |
| Printer | HP LaserJet Series | RS232 Interface & Command Set |
| High Voltage Probe | Fluke 80K-40 | 40kV Maximum |
| High Resolution Color Display Monitor (Required for 8003 Option 02 Only) | NEC Multisync | 31 kHz Line Rate<br>60 Hz Field Rate<br>RGB Input |
| Color Analyzer | Minolta TV-2130 | |

# CALIBRATION CHECKS AND ADJUSTMENTS

Before starting the calibration checks and adjustments, the top cover should be removed to allow access to the adjustment potentiometers (pots) on the various PC boards, and to perform the lithium battery check listed below. (See Figure M2-1 on page M2-3 for pot locations.)

## Lithium Battery Check

After the cover is removed and before turning the instrument on, the lithium battery used to keep alive the non-volatile memory should be checked. The battery is located on the back of the front panel beside the speaker, just left of the spin knob. The battery voltage should be >3V. The battery should be replaced every six months, ***See page M2-28 at the end of this chapter for complete information on battery replacement.***

## Power Supply Check

*Do not turn on the unit until specified in the following check.*

**CAUTION: DO NOT Connect or Remove the HV Probe in the Following Check With the Power Turned ON. Arcing and Damage to the Power Supply Can Result.**

1. Remove the metal cover from the top of the Power Supply and the CRT.

2. Measure the CRT Anode voltage as follows:

   a. Connect the high voltage (HV) probe to the CRT anode by gently pushing the probe tip behind the plastic cover of the anode clip, and then into the clip. Set the DVM to the 200V range to get a 10 megohm input resistance for the HV probe.

   b. Turn ON the 8003.

   c. If necessary, adjust A1R123 (HORIZ VOLT) for 16kV ± 200V.

   d. Turn the 8003 OFF.

   e. Remove the HV probe.

   f. Turn the 8003 back ON.

3. Attach DVM HI lead to A6TP1, and DVM LO lead to A6TP4.

   a. Check for a reading of +5V ± 0.25V

4. Move DVM HI lead to A6TP3.

   a. Check for a reading +15V ± 0.45V

5. Move DVM HI lead to A6TP5.

   a. Check for a reading of -15V ± 0.45V

The instrument should now be allowed to warm up for 30 minutes.

## Check Display

1. Check for gray scale as follows: (Note the location of the following adjustment pots per the labeling on the top shield.)

   a. Disconnect A2J2 (rear ribbon cable) to eliminate the video drive.

   b. Adjust the INTENSITY (SCREEN) pot CW until the display changes from black to gray, and is just bright enough to see it clearly. If the display makes the transition from black to gray with no other hues (colors) evident, skip to Step 1.c. If the screen is not gray (has a slight red, green or yellow hue), adjust the background pots A2R24, A2R34, and A2R44 for a gray color on the display.

   c. While adjusting the INTENSITY (SCREEN) pot CCW, verify that the screen stays "gray" until a black background appears.

   d. Reconnect A2J2.

2. Turn OFF the 8003 and replace the metal cover on top of the CRT and Power Supply. Turn ON the 8003.

3. Adjust the ***front panel*** Intensity pot on the 8003 fully CW, and change the color to white by pressing System **CONFIG** → *SERVICE* → *TEST PATTERN* → *1 COLOR*

   [**CONFIG**] [*SERVICE*] [*TEST PATTERN*] [*1 COLOR*]

   A white screen will be displayed.

4. Set the Color Analyzer to the CHROMA mode. Place the Color Analyzer Probe on the center of the 8003 display, and adjust the color as follows:

   a. Note the x, y, and Y readings of the 8003 display as measured by the Color Analyzer, and compare them to the following:

$$\begin{aligned} x &= (281 \pm 05) \\ y &= (311 \pm 05) \\ Y &= (160 \pm 10) \end{aligned}$$

NOTE: A minor adjustment of one or two counts (as monitored on the Color Analyzer) of the Blue Intensity pot (Y), A2R36, causes a major change in both x and y.

1. If the 8003 display readings are close, skip to Step 4.a.2. If the readings are not close, turn the three intensity pots (A2R26, A2R18, and A2R36) to their approximate center position and proceed as follows

2. Adjust A2R26 (green intensity) so that y on the Color Analyzer reads 311 ± 05.

3. Adjust A2R18 (red intensity) so that x on the Color Analyzer reads 281 ± 05.

4. Adjust A2R36 (blue intensity) just one or two counts toward 160 ± 05.

5. Repeat Steps 4.a.2, 4.a.3, and 4.a.4 as required. If A2R36 reaches a mechanical stop before the adjustment is completed, re-center the pot and repeat Steps 4.a.2, 4.a.3, and 4.a.4 as required.

## Center Display

1. Place the large Grid test pattern on the screen by pressing *GRID* → *GRID*

2. If the Grid pattern does not fill the screen, adjust A1L8 (HORZ WIDTH) as required. Leave enough border space to be able to view the edge of the grid from a viewing position somewhat off center from the center of the screen.

3. Adjust A1R103 for horizontal centering, if required.

4. Press any key to return to a small grid and, if required, adjust A1R149 so that the middle large width bar on the right side of the display aligns with the corresponding bar on the bezel.

5. If necessary, adjust A1R145 (VERTICAL SIZE) so that the upper and lower large bars align with the corresponding bars on the bezel.

6. Adjust the FOCUS control for the sharpest focus.

7. Adjust the convergence, A2R46, so that all 3 colors converge on the screen to cause the screen to be white.

8. Press *DONE, RETURN* softkeys.

## CHECK FRONT PANEL KEY OPERATION

1. Press *SERVICE* softkey.
2. Press *TEST PATTERN* softkey.
3. Press each front panel key, one at a time. Verify that the display is correct as each key is pressed.
4. Press *DONE, RETURN* softkeys.

## SET TIME AND DATE

(if necessary)

[**CONFIG**] [*SERVICE*]
[*SET TIME*]
[*HOUR*] [**n**] [*GHz/dB*]
[*MINUTE*] [**n**] [*GHz/dB*]
[*SECOND*] [**n**] [*GHz/dB*]
[*DATE*] [**n**] [*GHz/dB*]
[*MONTH*] [**n**] [*GHz/dB*]
[*YEAR*] [**n**] [*GHz/dB*]

1. Press System **CONFIG.**→ *SERVICE.*
2. Press *SET TIME* softkey.
3. Press *HOUR*, use front panel numerical keys to input hour in military (24 hour) time. Then press *GHz / dB* softkey to enter.
4. Enter *MINUTE, SECOND, DATE, MONTH,* and *YEAR* using the same method. When complete, press the *DONE* softkey.

## CALIBRATOR CHECK

1. Press *SET CAL* softkey.
2. Connect the CAL OUT connection of the 8003 to the Frequency Counter. Verify that the frequency is 50 MHZ ± 1 MHz.
3. Press the *ABORT* softkey.
4. Connect the 432A to the Calibrator Output on the 8003 as shown in Figure M2-2, below.

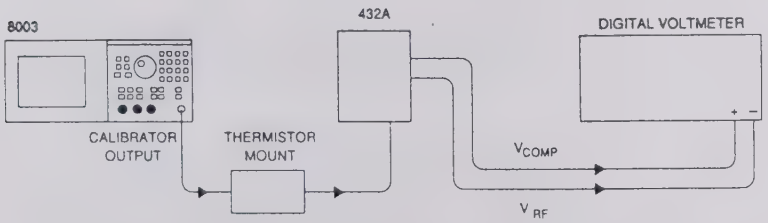



*Figure M2-2. Calibrator Output Power Reference Level Test Setup*

5. Set the 432A RANGE switch to COARSE ZERO, and adjust the front panel COARSE ZERO control to obtain a zero (± 2% F. S.) meter indication.

**NOTE: Ensure that the DVM input leads are isolated from chassis ground when performing the next step.**

6. Set the DVM to a range that results in a resolution of 1 μV and connect the positive and negative input, respectively, to the $V_{COMP}$ and $V_{RF}$ connectors on the rear panel of the 432A.

7. Fine zero the 432A on the most sensitive range, then set the 432A range switch to 1 mW.

8. Record the DVM indication as $V_0$.

9. Turn ON the 8003 Calibrator RF power as follows:

[CONFIG] [*SERVICE*] [*SET CAL*]

Press System **CONFIG** → *SERVICE* → *SET CAL*. Record the reading shown on the DVM as $V_1$.

**NOTE: The $V_1$ reading must be taken within 15 seconds after pressing *SET CAL*. Otherwise, press the *ABORT* softkey and repeat from Step 7.**

10. Disconnect the DVM negative lead from the $V_{RF}$ connector on the 432A, and reconnect it to the 432A chassis ground. Record the new indication observed on the DVM as $V_{COMP}$.

11. Press the *ABORT* softkey on the 8003.

12. Calculate the Calibrator Output level ($P_{CAL}$) using the following formula:

$$P_{CAL} = \frac{2V_{COMP}(V_1 - V_0) + V_0^2 - V_1^2}{4R\ (\text{CALIBRATION FACTOR})}$$

where:

| | | |
|---|---|---|
| $P_{CAL}$ | = | Calibrator Output power reference level |
| $V_{COMP}$ | = | previously recorded value in Step 10 |
| $V_1$ | = | previously recorded value in Step 9 |
| $V_0$ | = | previously recorded value in Step 8 |
| R | = | 200 Ω (assuming HP478A-H75 mount) |

CALIBRATION
FACTOR = value for the thermistor mount at 50 MHz (traceable to the National Institute for Standards Technology -- formerly the National Bureau of Standards)

13. Verify that the $P_{CAL}$ is within the following limits:

**1mW ± 0 .019mW**
(0.981 to 1.019mW)

(For record purposes, the measured value of $P_{CAL}$ can be entered on the Test Data Recording Sheet located on page M2-15.)

If it is desired or necessary to correct the power output, note the amount of error in percent and then change the *CAL CORRECTION* by that amount. Press *DONE*, and then repeat from Step 7. For example, if the power output is low by 0.25% (0.9975 mW) and the CAL CORRECTION is 98.75%, then enter a cal correction of 99.00% (98.75% + 0.25%).

## SENSOR CALIBRATION CHECK

1. Attach sensor to the CALIBRATOR output.

2. Press the Function **CAL** key

3. Press the *CAL SENSOR* softkey.
4. Attach sensor to channel A input, verify that the display changes from CH 1, Sensor A Not Present, to CH 1, Sensor A Not Calibrated.

5. Press the *SENSOR A CAL* softkey and observe the calibration process. A chime tone will sound when complete. Press *RETURN* → *ZERO SENSOR* → *SENSOR A ZERO*, and verify that the Auto Zero function passes. Observe that the CH 1 Summary Area at the top of the display now contains reference information.

[*RETURN*] [*ZERO SENSOR*] [*SENSOR A ZERO*]

6. Repeat from Step 2 to Step 6 for channels B and C.

7. Turn OFF the 8003, wait 10 seconds, then turn back ON and verify that by moving the sensor output connector to all channel receptacles that no sensor calibration information has been lost by power outage.

8. Attach the sensor head to the sweeper.

## Check Sensor EEPROMS

[CONFIG] [*SERVICE*]
[SENSOR EEPROM]
[*(Channel) SENSOR EEPROM*]

1. Press the System **CONFIG** key.
2. Press the *SERVICE* softkey.
3. Press the *SENSOR EEPROM* softkey.
4. Press *(whatever channel is being used) SENSOR EEPROM* softkey.
5. Verify that the sensor model and serial number on the display are the same as the sensor being used for the test.
6. Press *ABORT/CONFIG* softkey to return to tracking display. Then press the *ABORT PROGRAM* and *RETURN/CONFIG* softkeys to complete the return.

## CHECK PRIVATE GPIB

Turn OFF the 8003 and attach the sweeper system GPIB to the 8003's Private GPIB connection on the rear panel. Connect SWEEP OUT from the sweeper to SWEEP IN on the 8003. Connect the sweeper's PULSE IN to the AC MOD output of the 8003. Turn the 8003 ON to initialize the sweeper. If the sweeper does not initialize, make sure that the source address of the 8003 is matched with the sweeper and that the Private Bus function is ON.

## Check System Functions

[**CONFIG**]
[*GPIB DEVICES*]
[*PRIVATE BUS OFF*]

1. Press the System **CONFIG** key.
2. Press the *GPIB DEVICES* softkey.
3. Press the *PRIVATE BUS ON/OFF* softkey to OFF, and verify that the power and sweep time are inoperative (dark blue color with softkeys disabled) by pressing the source power and sweep time keys.

## Check Preset

[**CONFIG**] [*GPIB DEVICES*]
[*PRIVATE BUS ON* ]
[**PRESET**]
[*CONFIRM PRESET*]

1. Press the System **CONFIG** key, then the *GPIB DEVICES* softkey. Press *PRIVATE BUS ON/OFF* to turn the Private Bus function ON.
2. Press the System **PRESET** key.
3. Press the *CONFIRM PRESET* softkey.

4. Verify that the display shows the default display for the Wavetek 8910 Series or Marconi 6310 Series sweeper:

| | | |
|---|---|---|
| F1 | = | 10 MHz |
| F2 | = | 20 GHz |
| Time | = | 200 ms |
| P1 | = | -15 dBm |
| RF | = | OFF. |

## Check Source Functions on Front Panel

1. Press the Source **START** key on the 8003 front panel.
2. Set source to 3 GHz and verify that F1 shows 3 GHz on both the sweeper's display and the 8003 display.
3. Press the Source **STOP** key on the 8003 front panel.
4. Set the source to 18 GHz and verify that F2 shows 18 GHz on both the sweeper's display and the 8003 display.
5. Attach a sensor from the 8003 to the sweeper's RF output.
6. Press the Source **POWER** key, then press *RF POWER ON/OFF* softkey to the ON setting. Verify that a trace appears on the 8003 display and that a light appears at the RF switch on the source.
7. Set the power level to 0 dBm, input 0 on the front panel keypad, and then enter. Verify that the P1 indication on the Wavetek or Marconi source is 0 dBm.

## Check Sweep Time

1. Press the Source **SWEEP TIME** key.
2. Input 15 sec on the front panel keypad and verify 15 sec on both the sweeper's display and the 8003 display.

## Check Cal Zero

1. Press the Function **CAL** key.
2. Press *ZERO SENSOR* softkey.
3. Press *SENSOR (whatever sensor input used) ZERO* softkey and verify zeroing sensor (whatever sensor input used) on the 8003 display screen, and that the RF light goes out on the sweeper.

[**CONFIG**]
[*ZERO SENSOR*]
[*SENSOR X ZERO*]

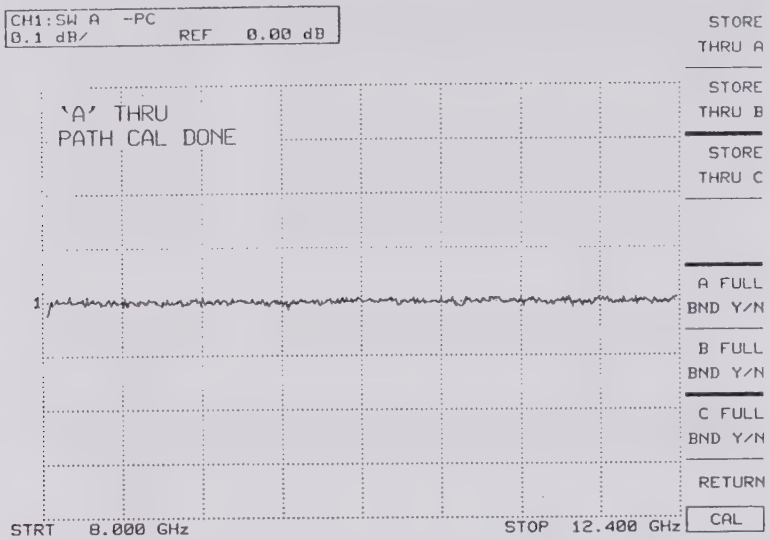



*Figure M2-3. Display of Calibrated Path*

## PATH CAL TEST

1. Connect the sensor to the sweeper RF output.
2. Press the Function **CAL** key, *THRU*, and the *STORE THRU* softkeys. Wait for Path Cal Done display.
3. Press the Function **SCALE** key, the *AUTOSCALE* softkey. Verify the channel display shows a straight line at 0.1 dB/DIV (similar to Figure M2-3 above).

## AC DETECTION TEST

[**MEAS**]
[*ABSPWR/PATHCAL*]
[**SCALE**]
[*AUTO SCALE*]

[**CONFIG**]
[*SENSOR AC/DC*]
[*SENSOR A AC/DC*]

1. Press the Function **MEAS** key, then *ABSPWR/PATHCAL* softkey to set channel 1 to absolute measurement. Press the Function **SCALE** and *AUTO SCALE* softkeys. Verify channel 1 displays a swept measurement.
2. Press the System **CONFIG** key, then *SENSOR AC/DC* and *SENSOR A AC/DC* softkeys. Verify no change on channel 1 display. (When AC detection fails, the display will undergo either a radical change or show lots of spikes.)

# WAVETEK MODEL 8003 CALIBRATION CHECK DATA RECORDING SHEET

NOTE 1: Copies should be made of this sheet before it is used, and kept with the manual. These copies can be utilized when future calibration checks are performed on this unit.

NOTE 2: While continuing step by step through the calibration checks, if it should be found that any specifications cannot be met by performing the indicated adjustments, immediately go to the Trouble-shooting instructions starting on page M2-17 and follow the procedures given therein.

Date: _____ Model 8003 Analyzer S/N: _____

Operator: _____

Test Number: _____ (if required) Temperature: _____ Humidity: _____

| CALIBRATION CHECK SECTION | | SPECIFICATION | READING |
|---|---|---|---|
| Power Supply Check. | Step 2.c | 15.8 to 16.2kV | |
| | Step 3.a | +4.75 to +5.25V | |
| | Step 4.a | +14.55 to +15.45V | |
| | Step 5.a | -14.55 to -15.45V | |
| Display Check | Step 4.a | x = 276 to 286 | |
| | | y = 306 to 316 | |
| | | Y = 150 to 170 | |
| Calibrator Check | Step 2 | 49.0 to 51.0 MHz | |
| | **Step 13** | **0.981 to 1.019mW** | |

(This page intentionally left blank)

# TROUBLE-SHOOTING PROCEDURES

**DANGER: Most of the circuits on the rear half of the power supply PC board are connected directly to the power line and can contain voltages in excess of 200V. EXERCISE EXTREME CAUTION WHEN MAKING MEASUREMENTS!**

Information given in this section should enable a technician to locate a malfunction and determine specifically which component on which PC board is causing the problem. Instructions are given in the form of a flow chart that describes basic problems that might arise, indicates which PC board could be causing the problem, and then leads the user to another flow chart to perform the troubleshooting steps for that particular PC board.

It is highly recommended that the electrical description given in Chapter M1 for the PC board of interest be reviewed and the schematic diagram (SD) for the board (shown in Chapter M3) studied before starting (and referred to during) any troubleshooting routine. (The description can be located by referring to the Table of Contents at the front of this manual, and the SD location can be found in the Index on page M3-1.)

In general, troubleshooting of the 8003 is divided into three parts. First the Preliminary Steps given given below are performed, then the Basic Troubleshooting Flow Chart shown on page M2-18 is followed to locate the PC board that might be causing the problem, and then the steps given in the flow chart for the PC board of interest are performed to localize the problem to a specific component.

## Equipment Required

The same equipment listed on page M2-5 will be required for performing the Troubleshooting procedures given in this section. Additionally, the WMI P/N 17716 Analog (short length) Extender Board is needed for troubleshooting the Calibrator PC Board (A5) and the Analog PC Board (A6), The WMI P/N 19155 Digital Extender (long length) Board will also be required for troubleshooting the Peripheral/Memory, Graphics, and CPU PC Boards (A10, A11, and A12).

## Preliminary Steps

Before starting the troubleshooting process, connect all of the necessary test equipment as follows:

First, connect a Model 80301 sensor to the A input of the 8003.

Then, interface a Wavetek Model 8900 series sweep generator to the 8003 as follows: (8003 connections are located on the rear panel)

- Connect the sweeper's System Bus to the 8003's GPIB Private Bus.
- Connect the sweeper's Sweep I/O to the 8003's Sweep In.
- Connect the sweeper's Pulse In to the 8003's Mod Out.
- Connect the sweeper's Sync Output to the 8003's Blanking In.

*Note that when measuring any of the analog signal voltages, an oscilloscope must be used since all 8003 measurement functions are dynamic. (i.e. the condition is set up, the voltage is digitized under the control of the CPU, and then the condition is cleared.)*

To get started on the Troubleshooting Flow Charts if the 8003 fails to turn on:

1. Check the fuse.

2. Check the power cord and power ON/OFF switch.

3. Making sure that the power is OFF, check the resistance of the thermal switch located on the back of the power supply heat sink (grid location C3 in Figure M2-1 on page M2-3). Any reading other than 0 ohms indicates that the switch is defective.

When performing Steps 4, 5, and 6, refer to the electrical description starting on page M1-7 and SD 19176 starting on page M3-9. Sheet 7 of SD 19176 on page M3-21 shows typical waveforms.

4. Making sure power is ON, check +15V local at A1TP2 (Power Supply Bd). This circuit consists of T1, CR1, CR2, R176, and C1.

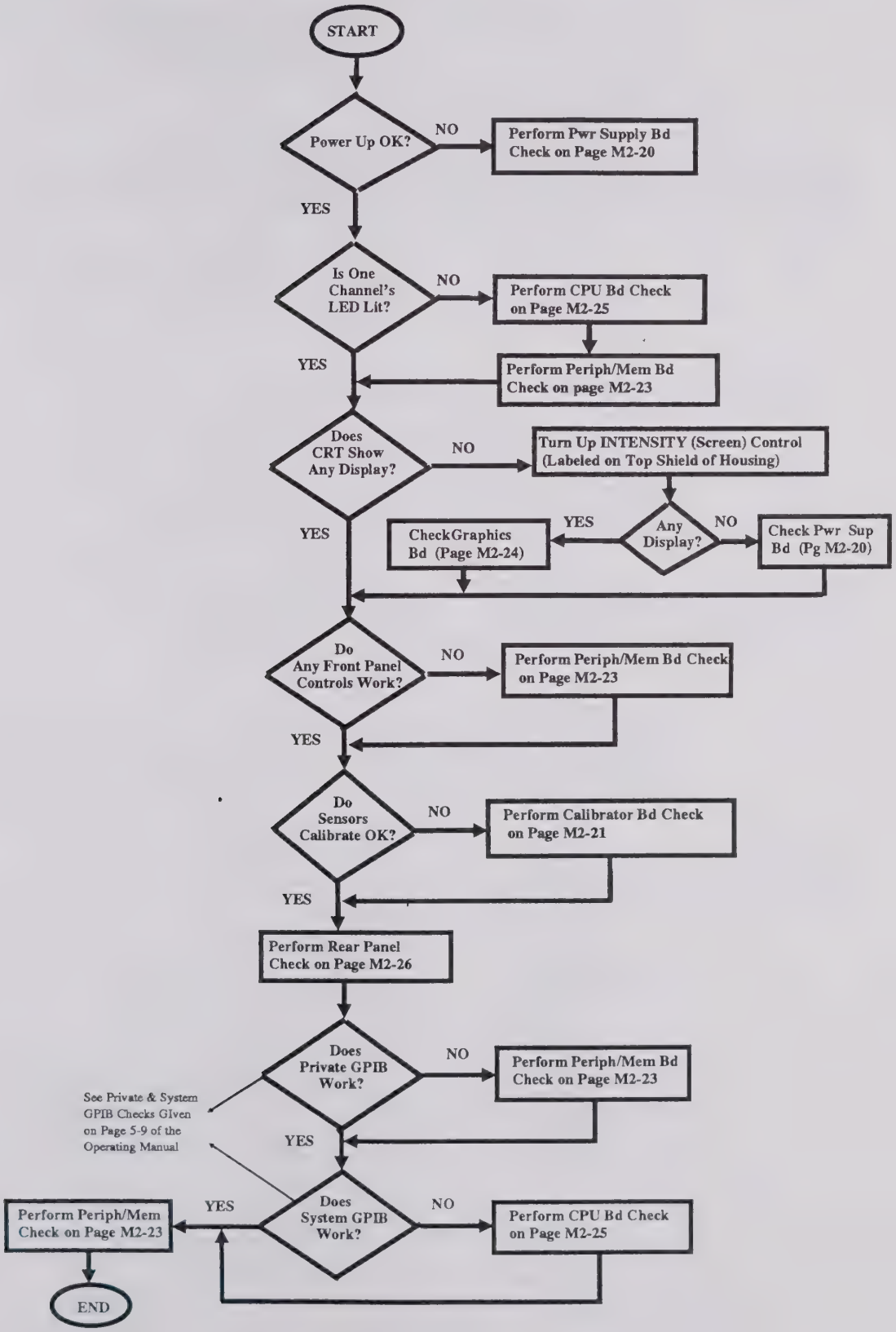
5. Check A1TP7 and A1TP12.

6. Check A1TP5.

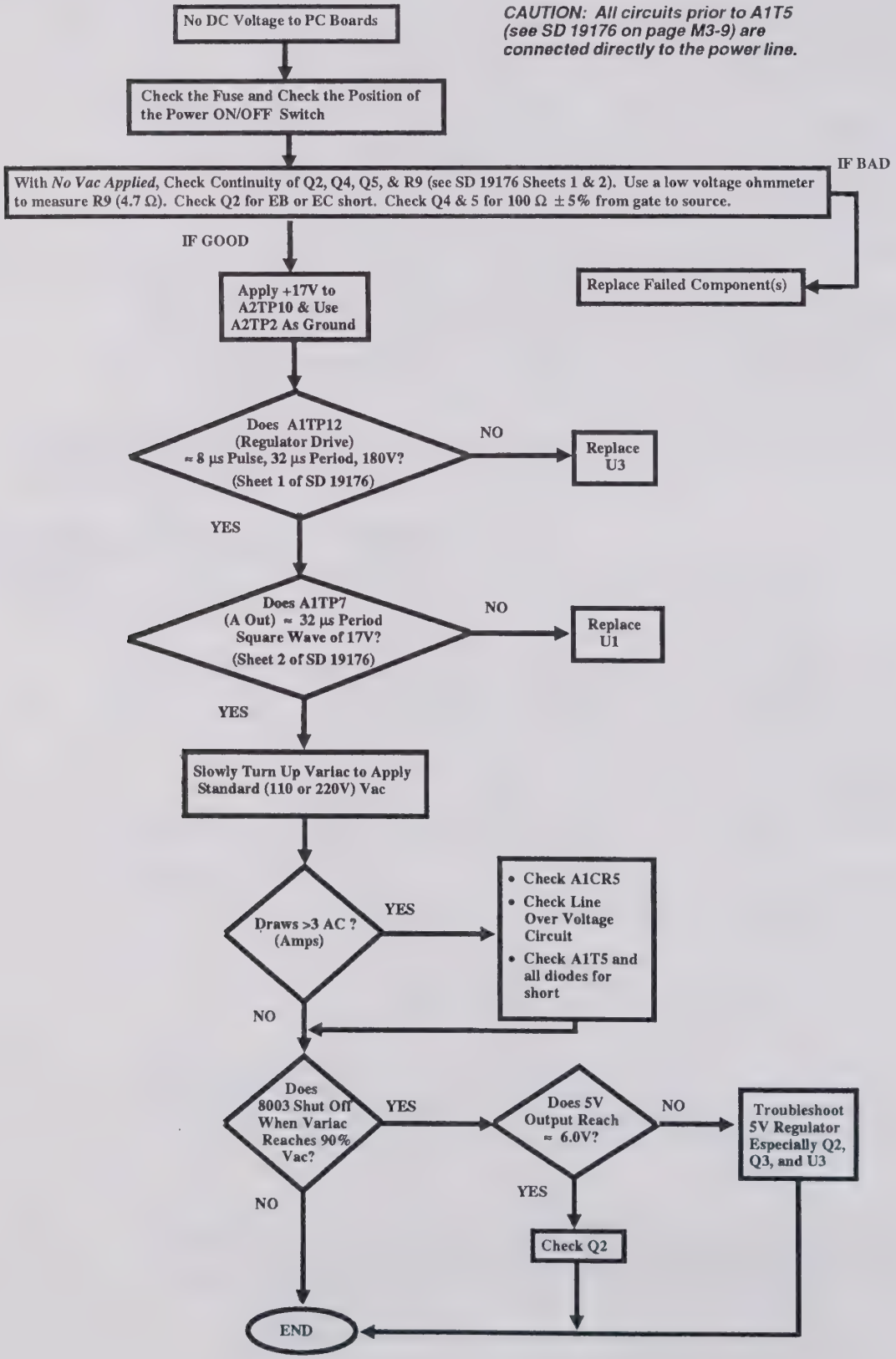
NOTE: The term "Check U or Q (number)" given in the flow charts means to also check all peripheral circuit components.

After making the connections and any necessary checks shown above, start the troubleshooting routine at the top of the Model 8003 Basic Troubleshooting Flow Chart given on the next page (M2-19).

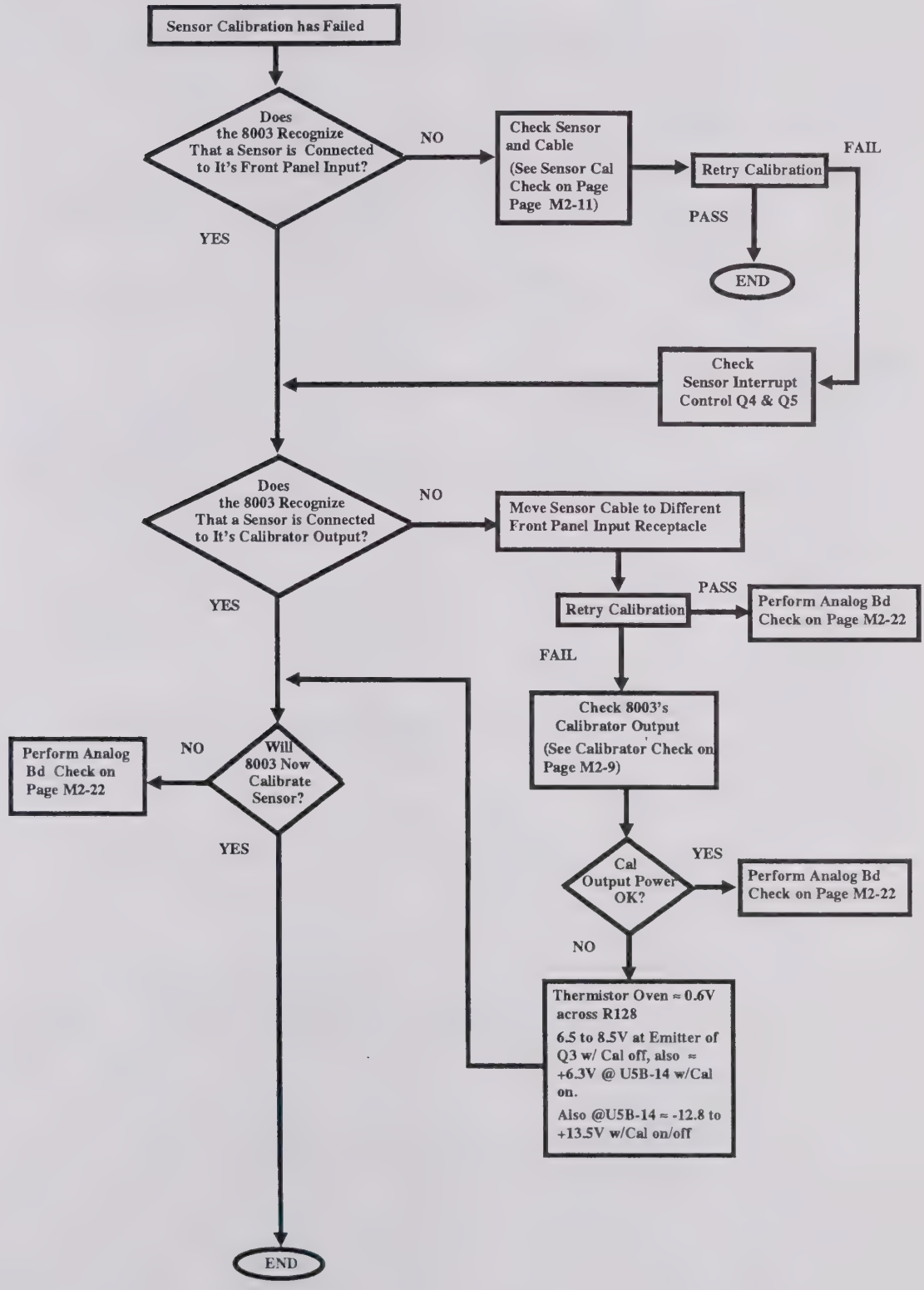
# MODEL 8003 BASIC TROUBLESHOOTING FLOW CHART

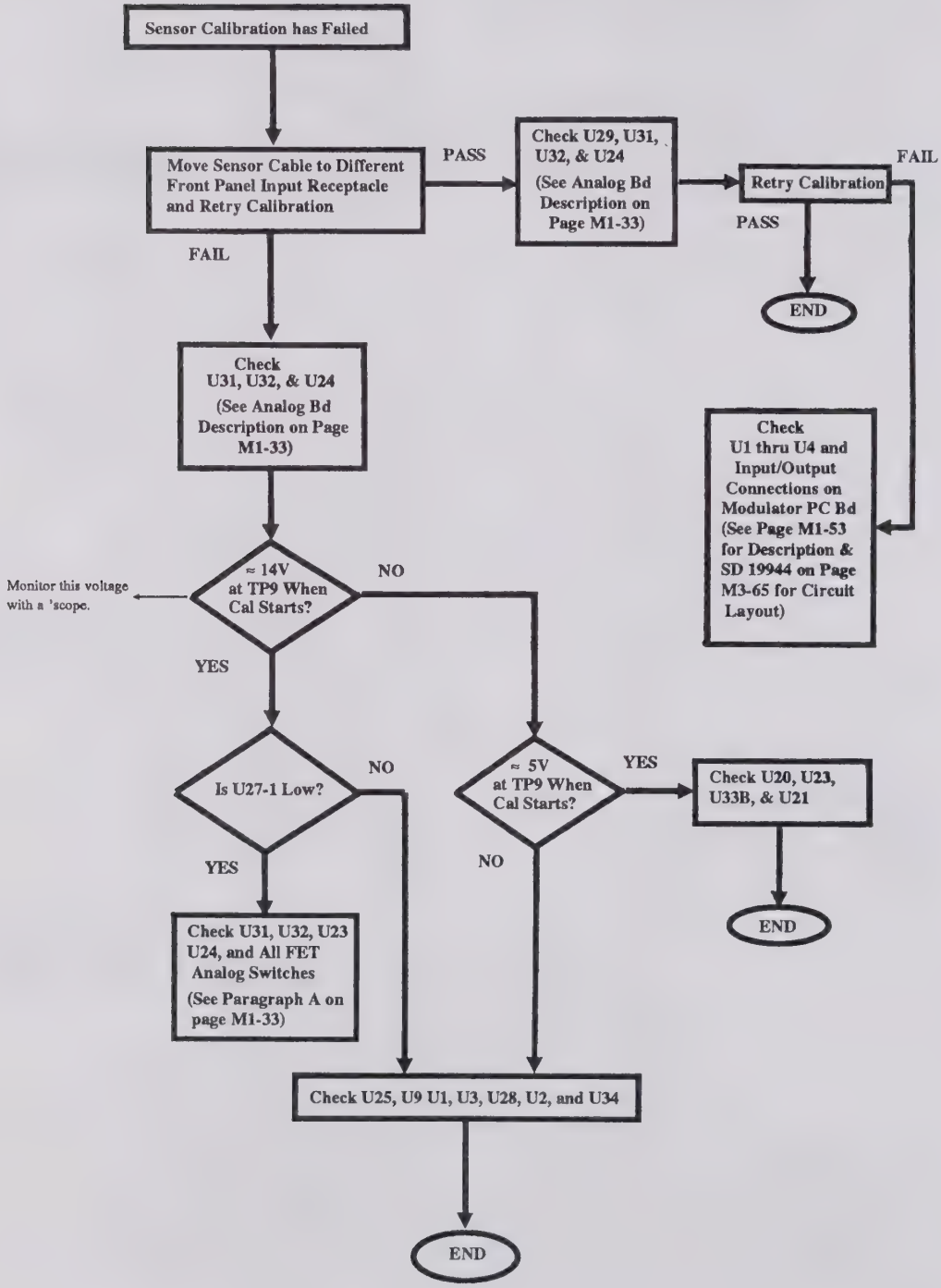


# MODEL 8003 POWER SUPPLY PC BOARD TROUBLESHOOTING FLOW CHART

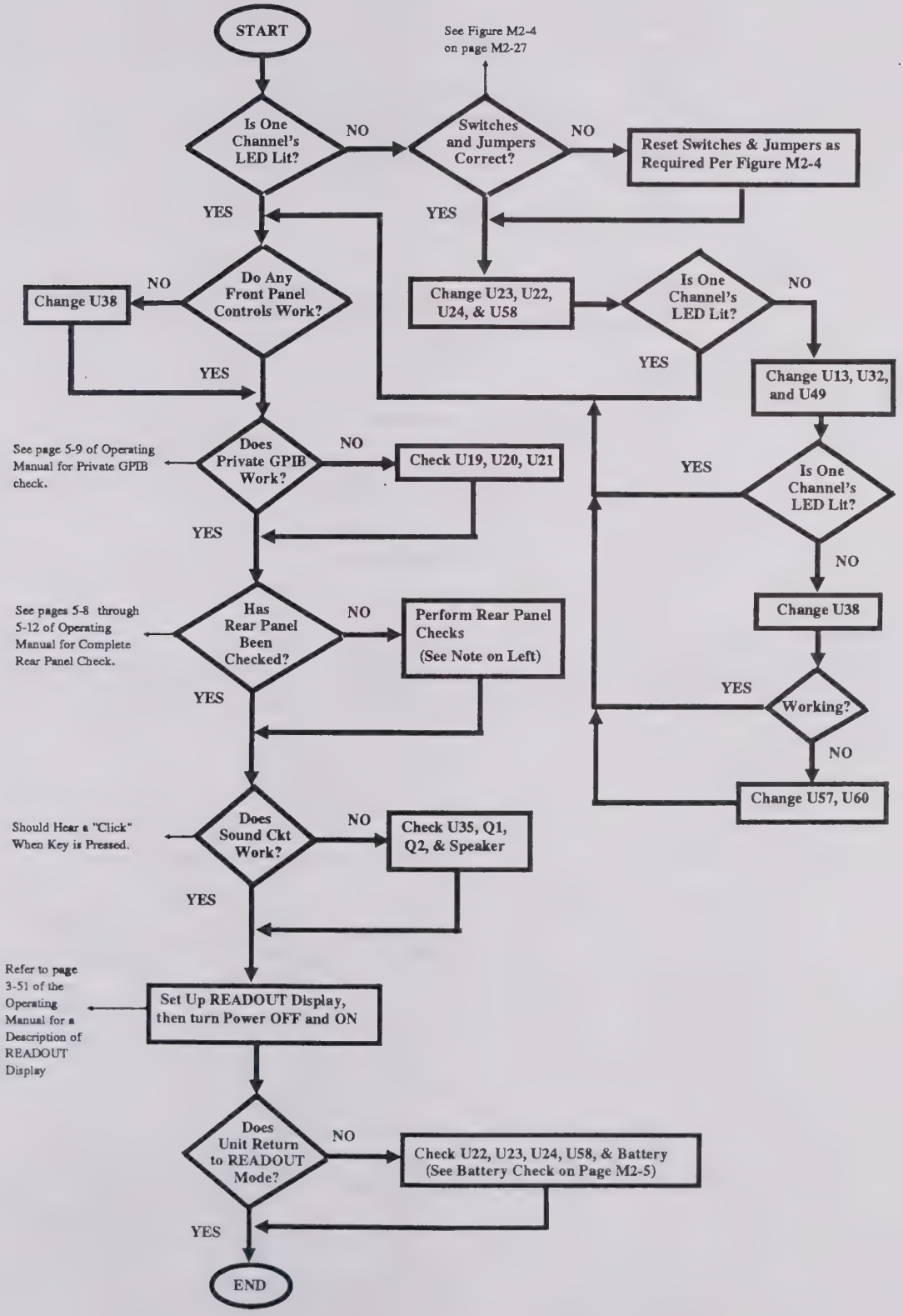

No DC Voltage to PC Boards
CAUTION: All circuits prior to A1T5 (see SD 19176 on page M3-9) are connected directly to the power line.
Check the Fuse and Check the Position of the Power ON/OFF Switch
With No Vac Applied, Check Continuity of Q2, Q4, Q5, & R9 (see SD 19176 Sheets 1 & 2). Use a low voltage ohmmeter to measure R9 (4.7 Ω). Check Q2 for EB or EC short. Check Q4 & 5 for 100 Ω ± 5% from gate to source.
IF BAD
IF GOOD
Replace Failed Component(s)
Apply +17V to A2TP10 & Use A2TP2 As Ground
Does A1TP12 (Regulator Drive) ≈ 8 µs Pulse, 32 µs Period, 180V? (Sheet 1 of SD 19176)
NO
Replace U3
YES
Does A1TP7 (A Out) ≈ 32 µs Period Square Wave of 17V? (Sheet 2 of SD 19176)
NO
Replace U1
YES
Slowly Turn Up Variac to Apply Standard (110 or 220V) Vac
Draws >3 AC ? (Amps)
YES
• Check A1CR5
• Check Line Over Voltage Circuit
• Check A1T5 and all diodes for short
NO
Does 8003 Shut Off When Variac Reaches 90% Vac?
YES
Does 5V Output Reach ≈ 6.0V?
NO
Troubleshoot 5V Regulator Especially Q2, Q3, and U3
YES
Check Q2
NO
END

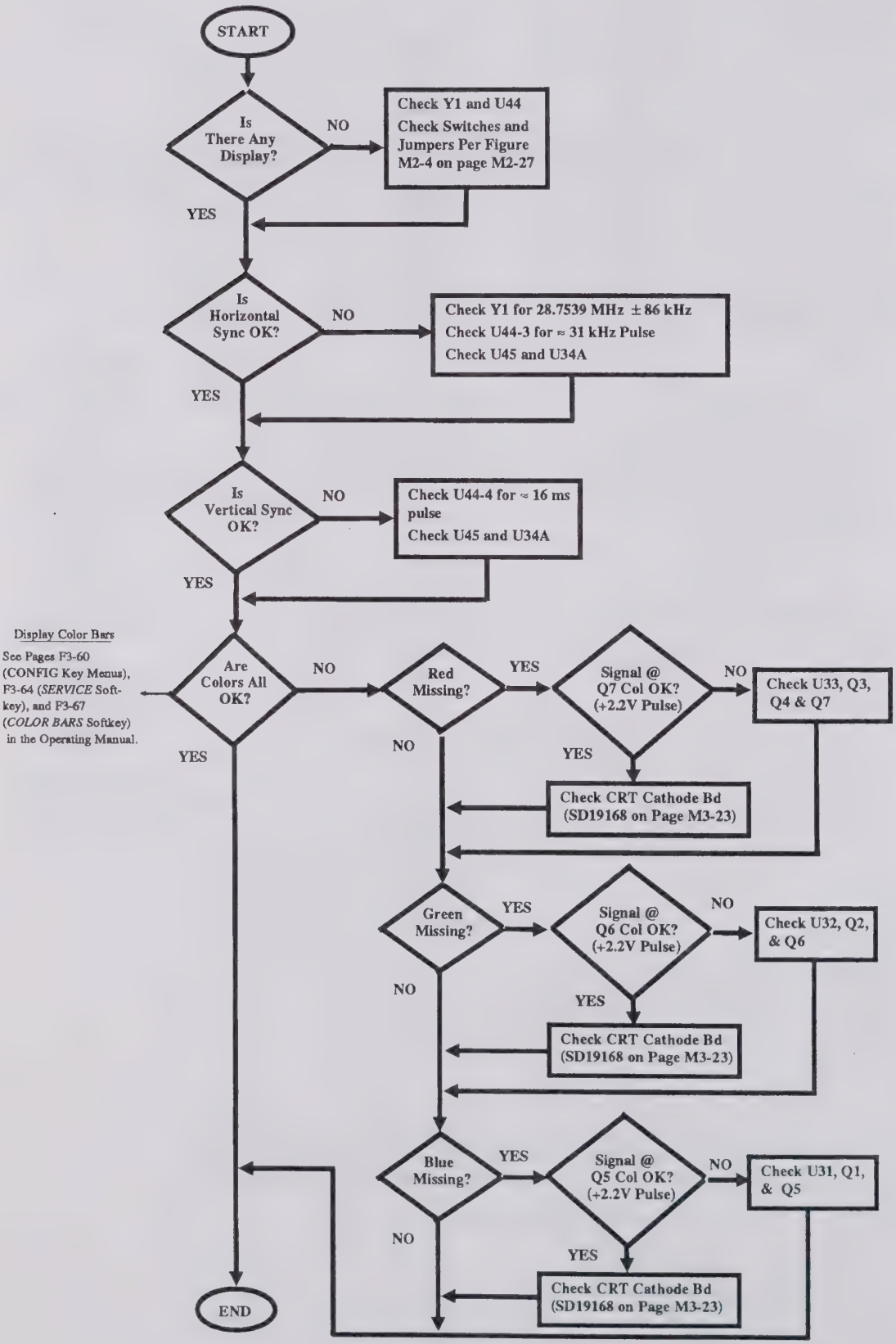
# MODEL 8003 CALIBRATOR PC BOARD TROUBLESHOOTING FLOW CHART


Sensor Calibration has Failed
Does the 8003 Recognize That a Sensor is Connected to It's Front Panel Input?
NO
Check Sensor and Cable
(See Sensor Cal Check on Page Page M2-11)
Retry Calibration
FAIL
PASS
END
YES
Check Sensor Interrupt Control Q4 & Q5
Does the 8003 Recognize That a Sensor is Connected to It's Calibrator Output?
NO
Move Sensor Cable to Different Front Panel Input Receptacle
Retry Calibration
PASS
Perform Analog Bd Check on Page M2-22
YES
FAIL
Check 8003's Calibrator Output
(See Calibrator Check on Page M2-9)
Perform Analog Bd Check on Page M2-22
NO
Will 8003 Now Calibrate Sensor?
YES
Cal Output Power OK?
YES
Perform Analog Bd Check on Page M2-22
NO
Thermistor Oven ≈ 0.6V across R128
6.5 to 8.5V at Emitter of Q3 w/ Cal off, also ≈ +6.3V @ U5B-14 w/Cal on.
Also @U5B-14 ≈ -12.8 to +13.5V w/Cal on/off
END

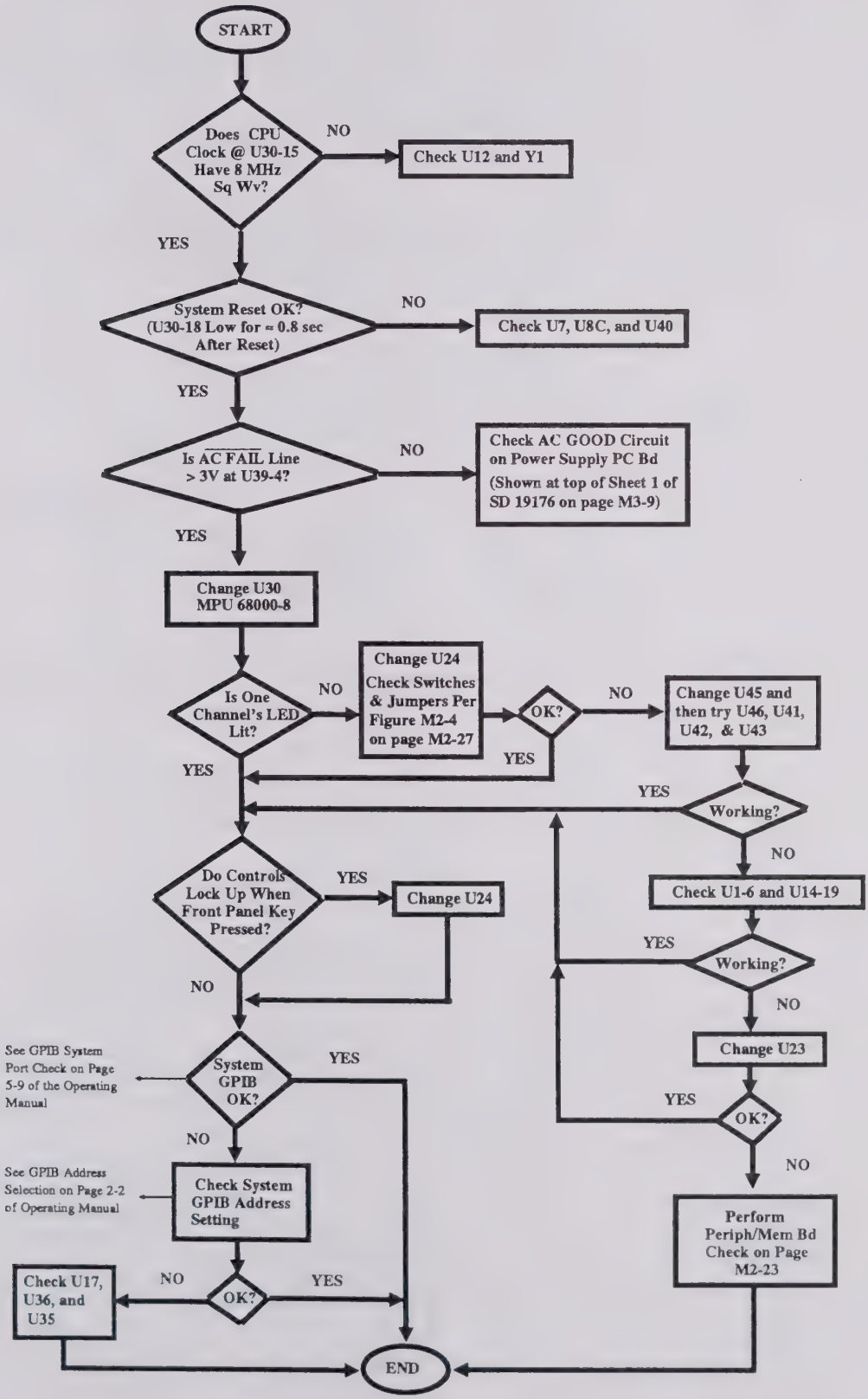

Sensor Calibration has Failed
Move Sensor Cable to Different Front Panel Input Receptacle and Retry Calibration
PASS
Check U29, U31, U32, & U24
(See Analog Bd Description on Page M1-33)
Retry Calibration
FAIL
PASS
END
FAIL
Check U31, U32, & U24
(See Analog Bd Description on Page M1-33)
Check U1 thru U4 and Input/Output Connections on Modulator PC Bd (See Page M1-53 for Description & SD 19944 on Page M3-65 for Circuit Layout)
≈ 14V at TP9 When Cal Starts?
Monitor this voltage with a 'scope.
NO
YES
Is U27-1 Low?
NO
YES
≈ 5V at TP9 When Cal Starts?
YES
NO
Check U20, U23, U33B, & U21
END
Check U31, U32, U23 U24, and All FET Analog Switches
(See Paragraph A on page M1-33)
Check U25, U9 U1, U3, U28, U2, and U34
END

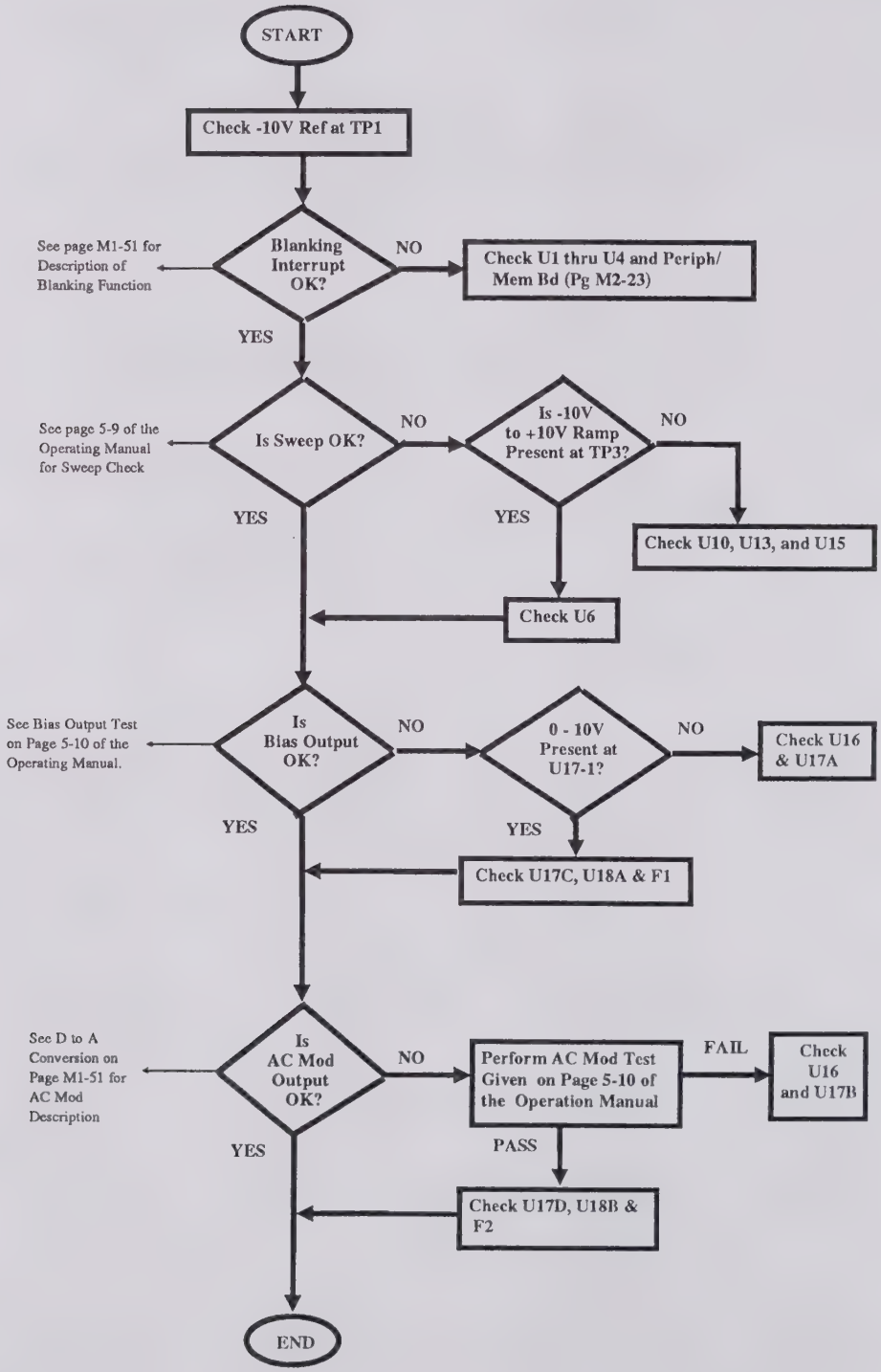
# MODEL 8003 PERIPHERAL/MEMORY PC BOARD TROUBLESHOOTING FLOW CHART




START
Is There Any Display?
NO
Check Y1 and U44
Check Switches and Jumpers Per Figure M2-4 on page M2-27
YES
Is Horizontal Sync OK?
NO
Check Y1 for 28.7539 MHz ± 86 kHz
Check U44-3 for ≈ 31 kHz Pulse
Check U45 and U34A
YES
Is Vertical Sync OK?
NO
Check U44-4 for ≈ 16 ms pulse
Check U45 and U34A
YES
Display Color Bars
See Pages F3-60 (CONFIG Key Menus), F3-64 (SERVICE Softkey), and F3-67 (COLOR BARS Softkey) in the Operating Manual.
Are Colors All OK?
NO
Red Missing?
YES
Signal @ Q7 Col OK? (+2.2V Pulse)
NO
Check U33, Q3, Q4 & Q7
YES
NO
YES
Check CRT Cathode Bd (SD19168 on Page M3-23)
Green Missing?
YES
Signal @ Q6 Col OK? (+2.2V Pulse)
NO
Check U32, Q2, & Q6
NO
YES
Check CRT Cathode Bd (SD19168 on Page M3-23)
Blue Missing?
YES
Signal @ Q5 Col OK? (+2.2V Pulse)
NO
Check U31, Q1, & Q5
NO
YES
Check CRT Cathode Bd (SD19168 on Page M3-23)
YES
END

# MODEL 8003 CPU PC BOARD TROUBLESHOOTING FLOW CHART




START
Check -10V Ref at TP1
See page M1-51 for Description of Blanking Function
Blanking Interrupt OK?
NO
Check U1 thru U4 and Periph/ Mem Bd (Pg M2-23)
YES
See page 5-9 of the Operating Manual for Sweep Check
Is Sweep OK?
NO
Is -10V to +10V Ramp Present at TP3?
NO
YES
YES
Check U10, U13, and U15
Check U6
See Bias Output Test on Page 5-10 of the Operating Manual.
Is Bias Output OK?
NO
0 - 10V Present at U17-1?
NO
Check U16 & U17A
YES
YES
Check U17C, U18A & F1
See D to A Conversion on Page M1-51 for AC Mod Description
Is AC Mod Output OK?
NO
Perform AC Mod Test Given on Page 5-10 of the Operation Manual
FAIL
Check U16 and U17B
YES
PASS
Check U17D, U18B & F2
END

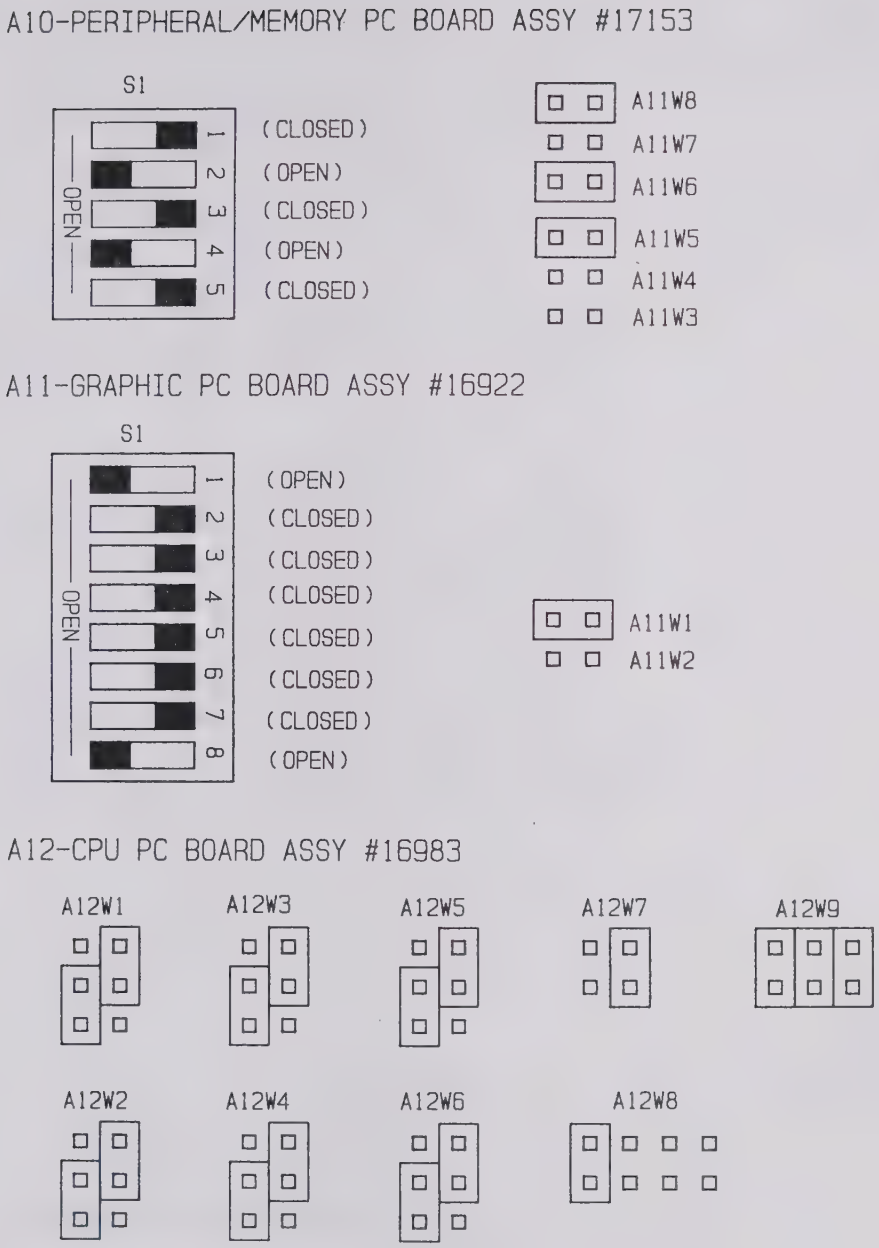



*Figure M2-4. Position and Location of Switches and Jumpers for the Indicated PC Boards*

(View is head-on from the front of the instrument)

# LITHIUM BATTERY REPLACEMENT

*(Recommended every six months)*

**CAUTION**: The following information describes a replacement procedure for the lithium battery in the 8003. Since this procedure requires removing the top cover from the instrument and then restoring power ***before*** removing the battery, this procedure should only be performed by qualified personnel.

Lithium batteries can supply substantial current and, depending on factors such as the state of charge, can overheat when shorted.

Information on testing the battery is given on page M2-5 of this chapter The following replacement procedure is intended for users knowledgeable in the use and care of equipment using non-rechargeable lithium batteries.

The 8003 uses a lithium battery to maintain power to the built-in clock chip and the static RAM used to store instrument data such as sensor linearity tables, power down status, stored setups, trace memories, limit lines, titles, etc.

Battery life varies depending on the usage of the 8003 but will be at least six months assuming normal daily use of the instrument. To save possible inconvenience that can be caused by the unintentional loss of data in the volatile memory of the 8003, it is recommended that the lithium battery be replaced every six months.

If the instrument is to be placed in long term (9 months or more) storage, the battery should be removed.

**Recommended Replacement Battery:** SAFT Type LS-6
Wavetek P/N 19972

## Battery Replacement Procedure

1. Turn OFF the 8003.
2. Remove the top cover.
3. Turn ON the 8003 (to maintain memory power while replacing the battery).
4. Note the polarity and orientation of the lithium battery (located on the back of the front panel, in front of PC board A5, beside the speaker and just left of the spin knob).
5. Remove the old battery and replace with the new one, being sure to observe the polarity and orientation of the new battery before installing it.

6. Turn OFF the 8003, and measure the battery voltage. It must be at least 3.5V.

NOTE: The Lithium Battery Check given on page M2-5 states that the old battery must measure >3V. If the old battery measures 3V or less it indicates that it is on the edge of failure and replacement should be considered. A new battery should always measure at least 3.5V.

7. Replace the top cover and secure.

8. If desired, a label can be attached indicating when the next battery replacement is due.

This completes the replacement procedure.

To test for satisfactory operation of the new battery turn ON the 8003, select to display Channel 1 only, turn the instrument OFF, wait 5 seconds, and then turn the instrument back ON. Satisfactory operation of the battery will be indicated by the instrument displaying just Channel 1 (part of the power down status).

Low battery voltage or a faulty battery will be indicated by a failure to restore the instrument status prior to power down, and/or if the instrument powers up in the PRESET condition (see page F3-61 of the Operating Manual for a description of PRESET).

SECTION

MANUAL CORRECTIONS

This section lists the corrections that must be incorporated in this manual to make it correspond to a particular instrument. The serial number of each instrument is prefixed by a code number. This code number is used to identify the applicable manual corrections for a particular instrument. When correcting this manual start with the corrections corresponding to the Code No. on the instrument. If a particular component has been changed more than one time, make only the first change encountered.

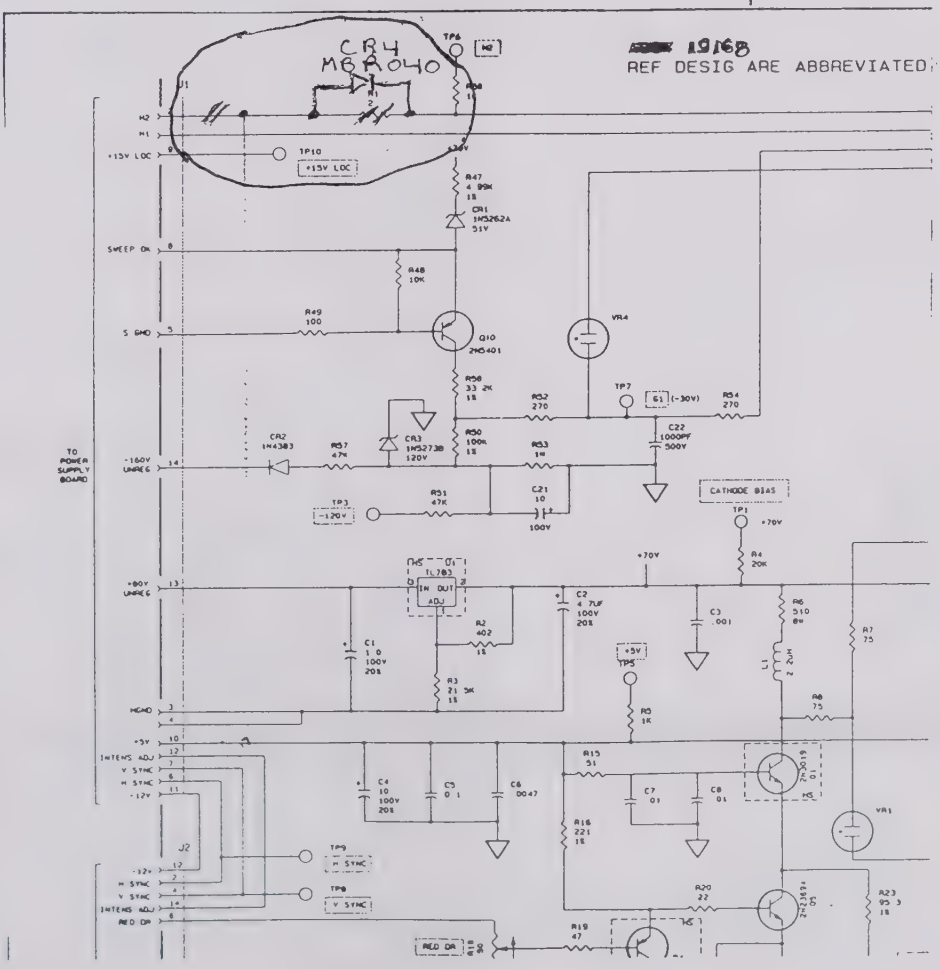
| CODE NO. | CORRECTIONS | PM PART NO. | SECTION OF MANUAL AFFECTED |
|---|---|---|---|
| 09A and 11 | On page M1-2, change Ass'y No. and SD No. of A10 (Peripheral/Memory PC Board) from current listing to the following:<br>Ass'y No. 21017<br>SD No. 21018<br>On page M1-17, change sentence below A10 heading to read "(See SD 21018 on page M3-43)"<br>On page M3-1, change A10 drawing numbers as shown above.<br>On page M4-1, change Peripheral/Memory Assembly # to 21017. Make the same change to the parts list heading on page M4-24.<br>On page M4-26, change A10U53 as follows:<br>A10U53 21012 (Same) General Instruments AY-3-8912A | | |

SECTION

MANUAL CORRECTIONS

This section lists the corrections that must be incorporated in this manual to make it correspond to a particular instrument. The serial number of each instrument is prefixed by a code number. This code number is used to identify the applicable manual corrections for a particular instrument. When correcting this manual start with the corrections corresponding to the Code No. on the instrument. If a particular component has been changed more than one time, make only the first change encountered.

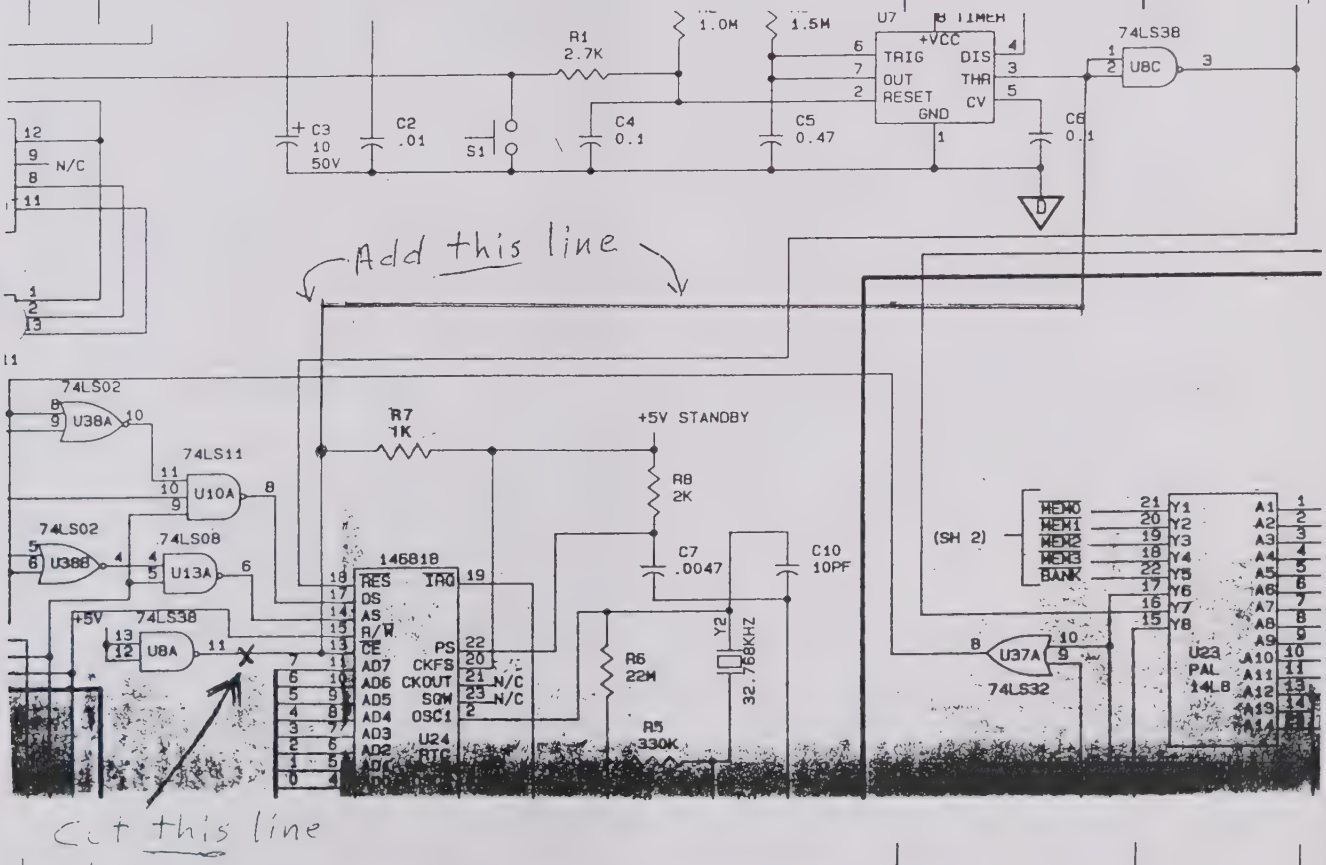
| CODE NO. | CORRECTIONS | PM PART NO. | SECTION OF MANUAL AFFECTED |
|---|---|---|---|
| 11<br>09A<br>09B | On page M4-11, change A2R1 from current listing to NOT USED. Add below A2CR3 the following:<br>A2CR4 20517 Diode, Rectifier, Schottky Power Motorola MBR040<br>On page M3-23, SD 19168, change the circuit as shown in the circled area below: | | |



MANUAL CORRECTIONS

This section lists the corrections that must be incorporated in this manual to make it correspond to a particular instrument. The serial number of each instrument is prefixed by a code number. This code number is used to identify the applicable manual corrections for a particular instrument. When correcting this manual start with the corrections corresponding to the Code No. on the instrument. If a particular component has been changed more than one time, make only the first change encountered.

| CODE NO. | CORRECTIONS | PM PART NO. | SECTION OF MANUAL AFFECTED |
|---|---|---|---|
| 11<br>09A<br>10 | On page M4-11, change P/N ONLY of A2Q4, A2Q6, and A2Q8 from current listing to: | 17303 | M4 |
| | On page M3-57, SD 16984 Sheet 1, change the circuit configuration as shown below. | | M3 |



# CHAPTER M2

# MAINTENANCE

## INTRODUCTION

This section of the manual defines maintenance practices, calibration adjustments, and troubleshooting checks required for fault isolation down to PC board component level.

It should be remembered that problems can occur that might be produced by equipment or components peripheral to the 8003 unit. Preliminary checks should be made to be sure that external equipment or components are not causing what appears to be a malfunction within the instrument.

## PERIODIC MAINTENANCE

The following maintenance procedures should be performed once each year unless the analyzer is operated in an extremely dirty or chemically contaminated environment, or is subjected to severe abuse (such as being dropped). In such cases, more frequent maintenance (immediate, if the unit is dropped or severely abused in some way) is required.

A. Blow out all accumulated dust and dirt with forced air under moderate pressure. Also, **the air filter for the cooling fan on the rear panel of the instrument should be checked every 3 months for accumulated dust.** A dirty filter could restrict the air flow into the unit to the point where the instrument could overheat, possibly causing the thermal sensor to shut down the instrument in the middle of a testing routine. If dirty, the filter should be removed, cleaned with a mild detergent and water solution, and replaced. (If necessary, replacement filters can be ordered from the factory.)

   Removal of the air filter from its holder is accomplished by snapping the retainer out of its holder. **Do not remove the screws from the filter holder.**

B. Inspect the unit for any loose wires or damaged components. Check to see that the unit's PC boards are properly seated in their receptacles, and that all wire lead connectors are properly attached to their PC board pins.





C. The front panel and housing of the unit can be cleaned using a cloth dampened in a mild detergent. Do not use abrasive cleaners, scouring powders, or any harsh chemicals. Wipe the soap residue off with a clean, damp cloth, then dry with a clean dry cloth.

D. Make a performance verification check in accordance with the procedures given in Chapter 5 of the Model 8003 Operating Manual. If the performance is within the required specifications, no further service is necessary.

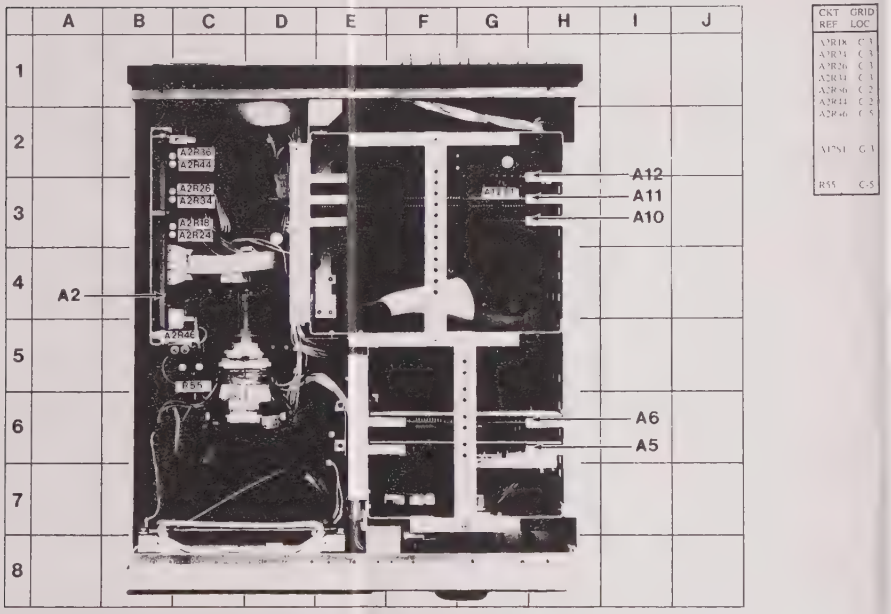
## CALIBRATION

The Model 8003 Analyzer has been designed and constructed to be extremely rugged and reliable. Consequently, there is very little drift due to component aging, and adjustments to the units are rarely required. If measurements indicate that an adjustment is set within the indicated range, do not attempt to put it "right on". It is often the case that variations in the equipment being used to make the test account for small differences in measured values. Since some adjustments can be interactive, **Be Absolutely Sure That An Adjustment Is Really Required Before Making It.**

As an aid to executing the various calibration checks and adjustments given in this section, a distinction is made in the text between the front panel "hardkeys" and the CRT adjacent "softkeys". The "hardkeys" are shown in **BOLD** (for example, **CONFIG**), and the softkeys are shown in *ITALICS* (for example, *SENSORS AC/DC*). Also, to further clarify hardkey locations, the keypad group in which the hardkey is located will initially be listed with the first letter capitalized (e.g Source **START**, System **CONFIG**, etc).

**A Calibration Data Sheet covering the readings defined on pages M2-6, M2-7, and M2-10 is located on page M2-15. This sheet can be removed, copied, and the copy used for recording test and calibration data readings, if required.**

**THIS PAGE IS PART OF A FOLD-OUT SHEET. PLEASE FOLD THIS SHEET OUT TO THE LEFT AND CONTINUE WITH THE TEXT ON PAGE M2-5.**




| CKT REF | GRID LOC |
|---|---|
| A2R16 | C 1 |
| A2R24 | C 1 |
| A2R26 | C 1 |
| A2R34 | C 1 |
| A2R36 | C 2 |
| A2R44 | C 2 |
| A2R46 | C 5 |
| A12S1 | G 1 |
| R55 | C 5 |

*Figure M2-1. Location of 8003 Calibration Components*





(This page intentionally left blank)

## SYSTEM GPIB

The system GPIB is used to control the 8003 in an ATE environment. It uses the TMS9914 controller chip, U27. The CPU interface includes the use of U37A/B for decoding. I/O buffering is done by U35 and U36. The jumper set W7 allows selection of the direction of the IFC and REN lines. The B position is used to set the direction to receive, as is required for remote control.

## SYSTEM RESET

The System Reset circuit consists of a monostable mv, U7, and an output inverter. At power up or if the hardware reset switch is closed, U 7 will generate a positive pulse about 0.8 sec in length. This pulse is inverted by U8C and then applied to the CPU chip, as well as other boards on the VME bus.

**THIS PAGE IS PART OF A FOLD-OUT SHEET. PLEASE FOLD THIS SHEET OUT TO THE LEFT AND CONTINUE WITH THE TEXT ON PAGE M1-51.**





(This page intentionally left blank)

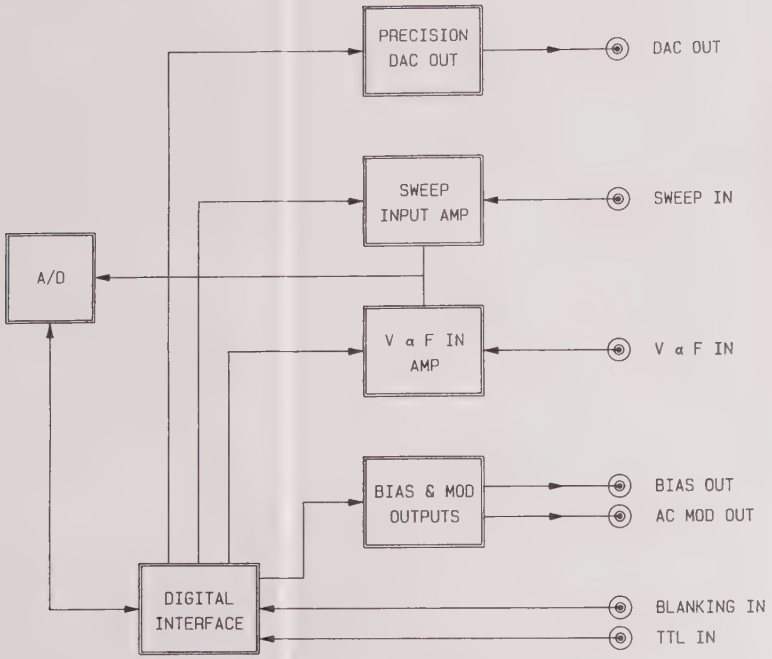



*Figure M1-7. Rear Panel PC Board Block Diagram (#A13)*





(This page intentionally left blank)

# Digital Interconnect PC Board (#A9)

(See SD 17708 on page M3-39)

This board has only the VME bus connections for the digital control circuits of the 8003. This includes the bus terminators which are the 330 ohm resistor arrays A9RP2, 3, 5, 7, 9, 11, 13, and 16 which connect to +5 volts, and the 470 ohm resistor arrays A9RP1, 4, 6, 8, 10, 12, 14, 15 which connect to ground. This combination results in the equivalent of about 200 ohms from about 3 volts as a termination for all the high speed lines.

**THIS PAGE IS PART OF A FOLD-OUT SHEET. PLEASE FOLD THIS SHEET OUT TO THE LEFT AND START WITH THE TEXT ON PAGE M1-41.**





(This page intentionally left blank)

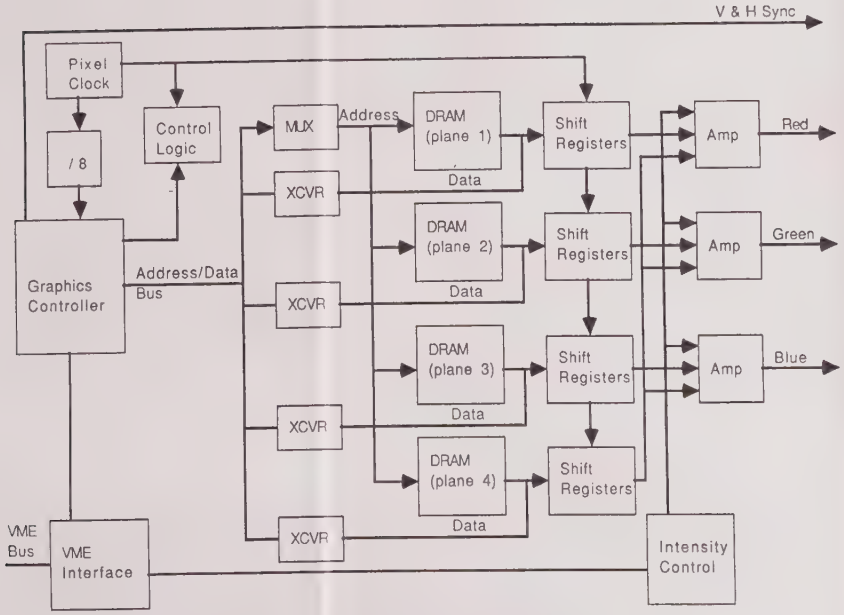



*Figure M1-5. Graphics PC Board Block Diagram (#A11)*





(This page intentionally left blank)

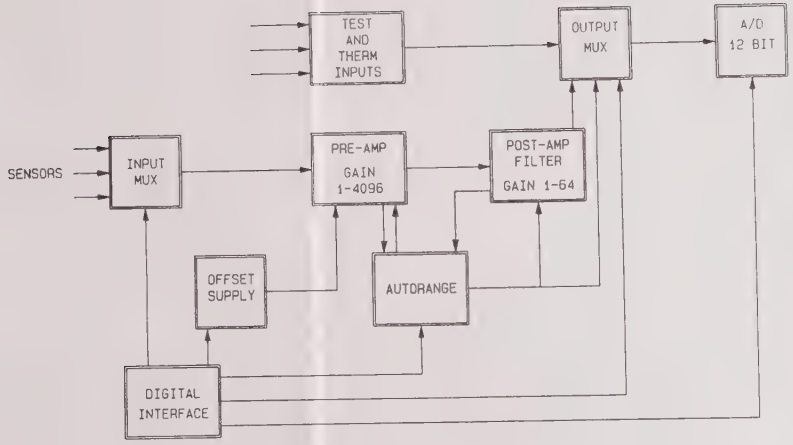



*Figure M1-4. Analog PC Board Block Diagram (#A6)*





(This page intentionally left blank)

## CALIBRATOR NVRAM CONTROL CIRCUIT

The calibrator serial number and the correction constant for the 0 dBm output level, as well as the date of calibration and password for rewrite access, is contained in a Non-Volatile RAM. The read and write for it is provided by the parallel peripheral interface (PPI) U13, a 1 of 8 decoder, U16, and an inverter, U15F. Before allowing access to the NVRAM, the software looks for a logic one on port A, bit one, of the PPI and, if that is present, it asks the operator for the password. If the correct password is supplied, then the collected data will be written into U20. If the jumper W1 is set to supply a logic 0 to the PPI, the operator will then have write access to U20 without needing a password.

## SENSOR NVRAM

Each sensor has a NVRAM which is used to store all of the calibration constants, the date of calibration, place of calibration, etc. This NVRAM is also password protected, but has no hardware switch to defeat it. The read/write control for it is furnished by the 1 of 8 decoder, U16, combined with U17D, Q4, and Q5 which control the 5V supply for U16. U16 is turned off except when it is being read or written in order to reduce the amount of heat in the sensor, as well as reducing the noise from the supply. The particular sensor is selected by the decoder, and the data is sent and received by a single line, RD0. This data is read from and written to by the PPI, U13.

## SENSOR INTERRUPT

Each time a sensor is connected or disconnected from the 8003, a CPU interrupt is generated by causing the thermistor voltage change to set a latch which signals the CPU that it needs to check for a sensor change. The latch is driven from a "window" comparator, U19 & U18C/D. This comparator is driven from capacitors which are connected to each of the thermistor lines from the sensors. The latch is enabled or cleared by a signal from the PPI, U13.

## DIGITAL CONTROL CIRCUIT

The digital control circuit is the interface between the CPU and the preceding functions.

**THIS PAGE IS PART OF A FOLD-OUT SHEET. PLEASE FOLD THIS SHEET OUT TO THE LEFT AND CONTINUE WITH THE TEXT ON PAGE M1-33.**



(This page intentionally left blank)

# Analog Interconnect PC Board (#A4)

(See SD 17232 on page M3-27)

The Analog Interconnect board contains the sockets for 3 analog boards and the calibrator board. Connectors are also available to connect 6 sensor inputs, the audio tone generation speaker, and the battery for the NV (Non-Volatile) RAM. The battery for the NV RAM is mounted at the front near the speaker. There is a resistor, A4R4, that is in series with the battery to provide a protective current limit in case of a circuit fault. This resistor is also useful for measuring the battery current. This will give an indication of the amount of life to be expected from the battery which has a capacity of about 200 Microamp years.

The modulator drive decoder, A4U1, is used to provide the required software actuation of the modulator switches located in the enclosure containing the front panel sensor connectors.

Digital signals from the front panel and to the Peripheral Memory board are also routed through this board.

The resistor array A4RP1 provides current for the temperature sensing thermistors physically located in the housings of each of the power sensors. The associated capacitors, A4C1 to A4C6 and A4C13, are used to provide sensor connect/disconnect information. A circuit on the calibrator board provides a CPU interrupt as a result of a voltage pulse across A4C13. This pulse will occur any time a sensor is added or removed.

**THIS PAGE IS PART OF A FOLD-OUT SHEET. PLEASE FOLD THIS SHEET OUT TO THE LEFT AND START WITH THE TEXT ON PAGE M1-25.**





(This page intentionally left blank)

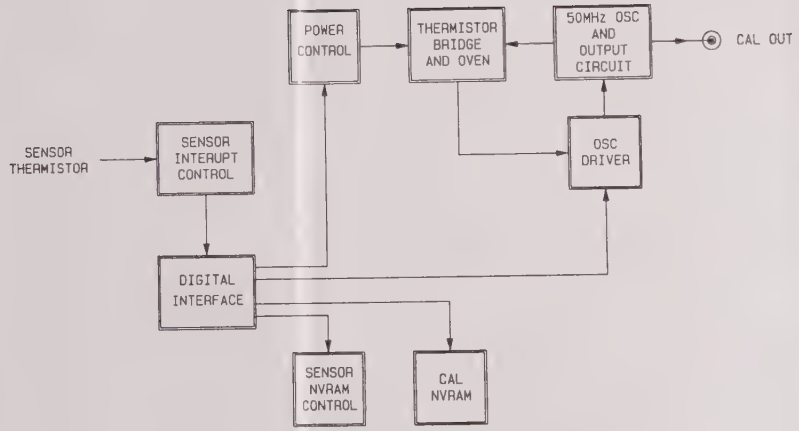



*Figure M1-2. Calibrator PC Board Block Diagram (#A5)*





(This page intentionally left blank)

# System Description

(See the overall system block diagram fold-out on the left and SD 19525 starting on page M3-3 in the Schematic Diagrams chapter for interconnect information.)

## SIGNAL PATH

The DC signals produced by the power sensors are connected first to the input multiplexer, and then to the preamplifier. The amplifier gain is controlled automatically as described in the discussion of the Analog PC Board starting on page M1-33. (Refer to the Analog PC Board Block Diagram on page M1-31 for signal flow information.) After the signal is amplified to greater than 1.2V, it is digitized and the result is processed by the CPU (see the CPU PC Board discussion starting on page M1-45).

## OTHER VOLTAGE PATHS

There are voltages from each of the sensors that represent their respective temperatures. These voltages are digitized at regular intervals during the normal data collection cycle, and processed by the CPU to provide correction for the temperature dependence of the diodes in the sensors.

There are additional voltages for test and maintenance which are digitized as required during the operation of the instrument. Other voltages are also used for external stimulus or response, and are discussed in the Rear Panel PC Board description on page M1-51.

**THIS PAGE IS PART OF A FOLD-OUT SHEET. PLEASE FOLD THIS SHEET OUT TO THE LEFT AND START WITH THE TEXT ON PAGE M1-7.**





(This page intentionally left blank)

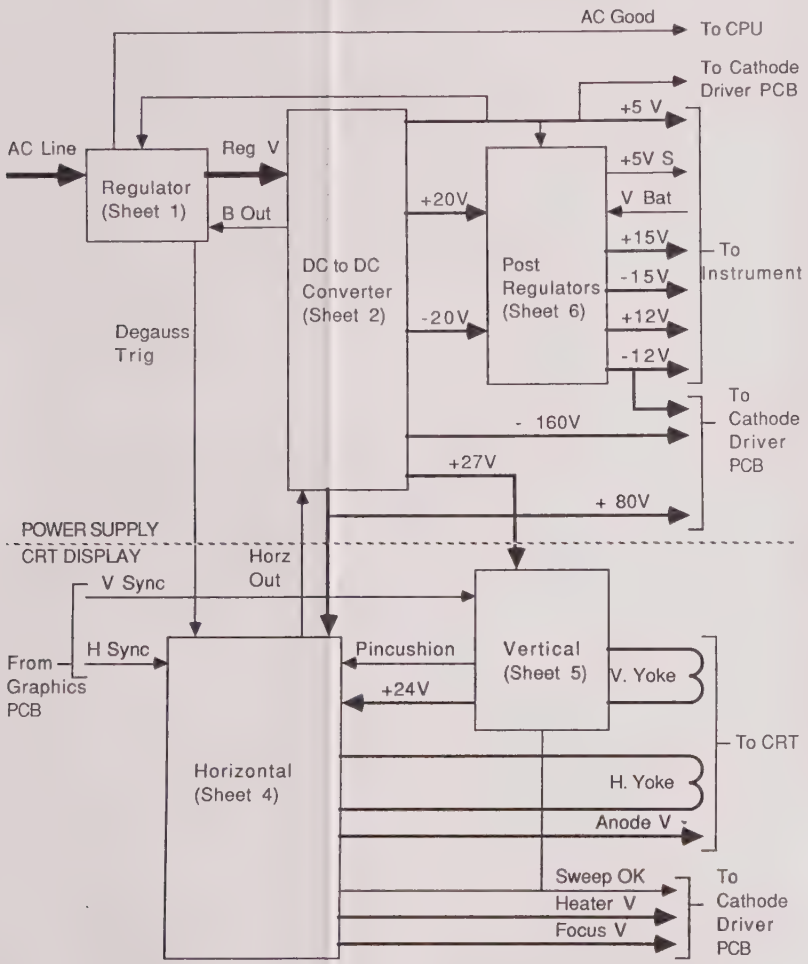



*Figure M1-1. Power Supply/CRT Display Block Diagram (#A1)*

(Sheet numbers in blocks refer to sheet numbers of SD 19176 starting on page M3-9)





(This page intentionally left blank)

# CHAPTER M1

# ELECTRICAL DESCRIPTION

## GENERAL

This chapter of the Model 8003 Maintenance Manual contains a functional description of the electrical circuits contained on the more complex PC boards and front and rear panel assemblies of the Model 8003 Precision Scalar Analyzer. Table M1-A on the next page lists all of the various circuit assemblies by their reference designations, and includes the Schematic Diagram (SD) and assembly part number for each board.

There is one electrical characteristic that is common to all of the PC boards in the 8003. This is the method used to provide the proper grounding configuration throughout the instrument. Each PC board contains both input and output isolator stages. The input stage is used to transfer the ground reference from the Reference or Ratio Common Ground used when signals are passing between boards , to an on-board Common Ground. When signals leave the board, they pass through the output isolator stage which transfers them back to the between-the-boards reference ground.

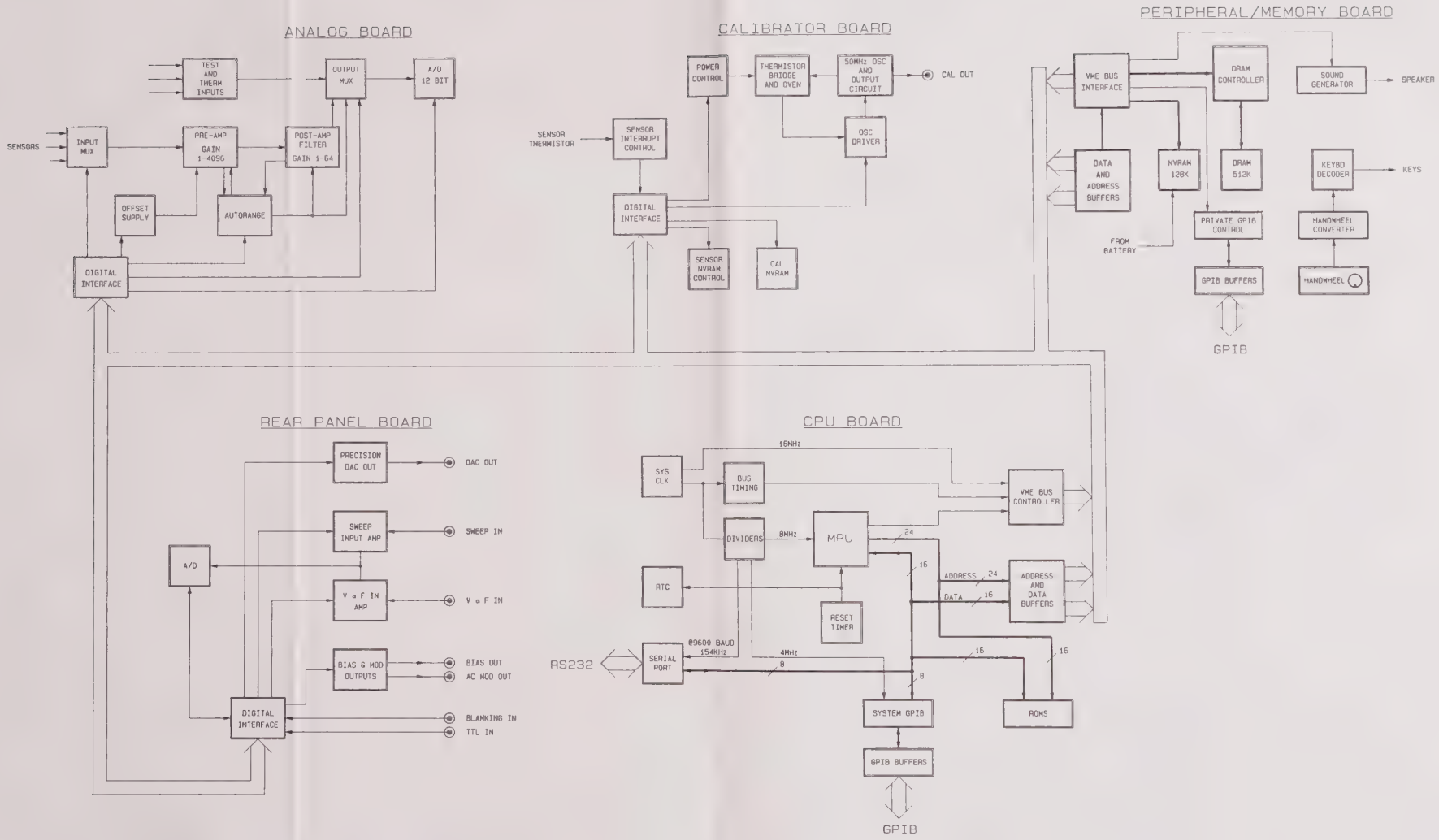




*Table M1-A. Model 8003 Circuit Assemblies*

| Ref. Desig. | Nomenclature | Ass'y. No. | SD No |
|---|---|---|---|
| A1 | Power Supply PC Board | 19175 | 19176 |
| A2 | CRT Cathode PC Board | 19167 | 19168 |
| A3 | Front Panel PC Board | 17228 | 17229 |
| A4 | Analog Interconnect PC Board | 17231 | 17232 |
| A5 | Calibration PC Board | 17169 | 17170 |
| A6 | Analog PC Board | 17288 | 17289 |
| A7 | Not Used | | |
| A8 | Not Used | | |
| A9 | Digital Interconnect PC Board | 17707 | 17708 |
| A10 | Peripheral/Memory PC Board | 17153 | 17154 |
| A11 | Graphics PC Board | 16922 | 16923 |
| A12 | CPU PC Board | 16983 | 16984 |
| A13 | Rear Panel PC Board | 19142 | 19143 |
| A14A1 | Modulator PC Board | 19943 | 19944 |
| A15 | CRT Socket PC Board | 20038 | 19525 |

**THIS PAGE IS PART OF A FOLD-OUT SHEET. PLEASE FOLD THIS SHEET OUT TO THE LEFT AND START WITH THE TEXT ON PAGE M1-3.**

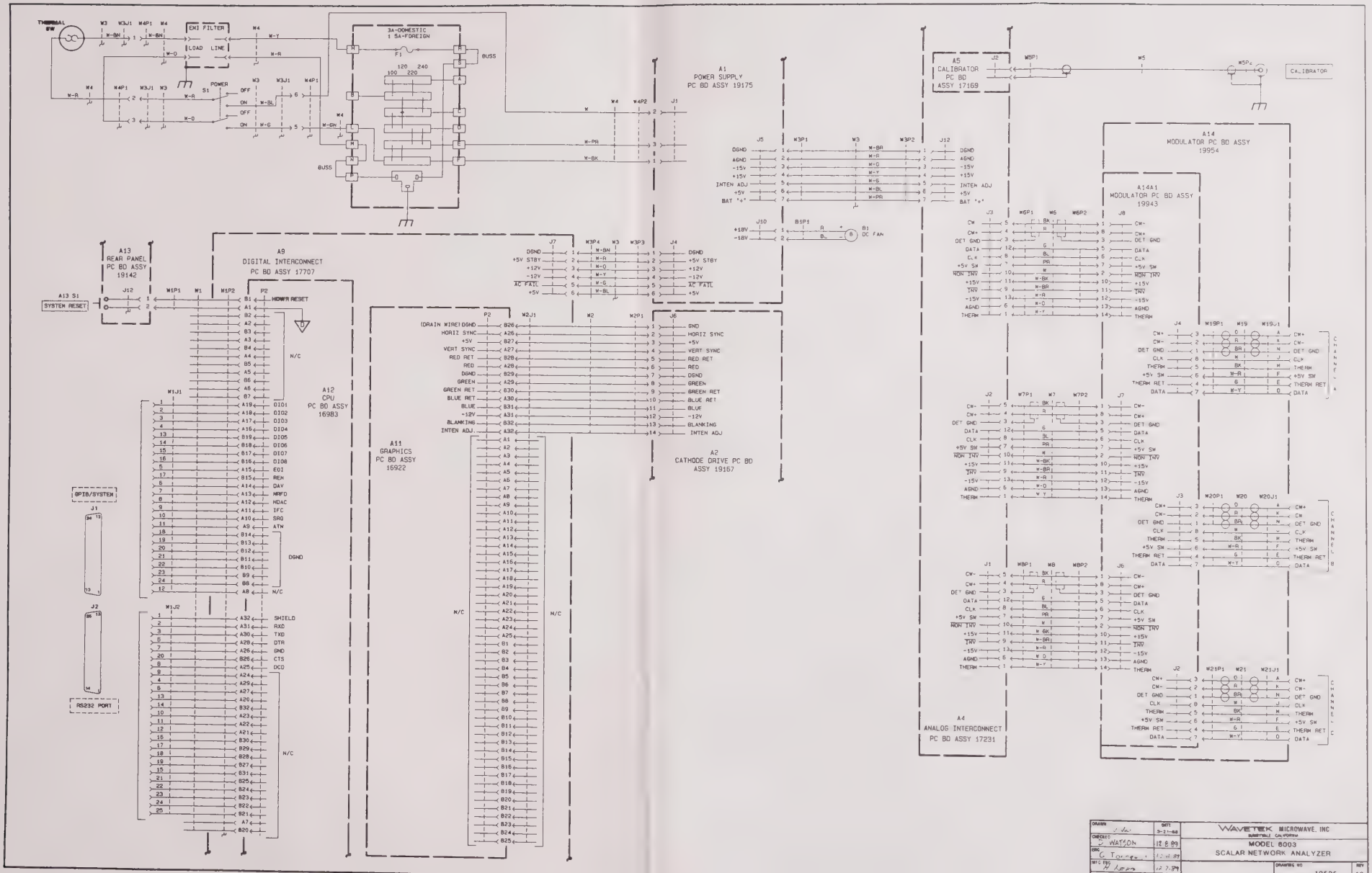

ANALOG BOARD
TEST AND THERM INPUTS
OUTPUT MUX
A/D 12 BIT
SENSORS
INPUT MUX
PRE-AMP GAIN 1-4096
POST-AMP FILTER GAIN 1-64
OFFSET SUPPLY
AUTORANGE
DIGITAL INTERFACE
CALIBRATOR BOARD
POWER CONTROL
THERMISTOR BRIDGE AND OVEN
50MHz OSC AND OUTPUT CIRCUIT
CAL OUT
SENSOR THERMISTOR
SENSOR INTERRUPT CONTROL
OSC DRIVER
DIGITAL INTERFACE
SENSOR NVRAM CONTROL
CAL NVRAM
PERIPHERAL/MEMORY BOARD
VME BUS INTERFACE
DRAM CONTROLLER
SOUND GENERATOR
SPEAKER
DATA AND ADDRESS BUFFERS
NVRAM 128K
DRAM 512K
KEYBD DECODER
KEYS
FROM BATTERY
PRIVATE GPIB CONTROL
HANDWHEEL CONVERTER
GPIB BUFFERS
HANDWHEEL
GPIB
REAR PANEL BOARD
PRECISION DAC OUT
DAC OUT
SWEEP INPUT AMP
SWEEP IN
A/D
V a F IN AMP
V a F IN
BIAS & MOD OUTPUTS
BIAS OUT
AC MOD OUT
DIGITAL INTERFACE
BLANKING IN
TTL IN
CPU BOARD
16MHz
SYS CLK
BUS TIMING
VME BUS CONTROLLER
DIVIDERS
8MHz
MPU
24
16
ADDRESS
24
DATA
16
ADDRESS AND DATA BUFFERS
RTC
RESET TIMER
RS232
@9600 BAUD 154KHz
SERIAL PORT
4MHz
8
16
16
8
SYSTEM GPIB
ROMS
GPIB BUFFERS
GPIB

# CHAPTER M3

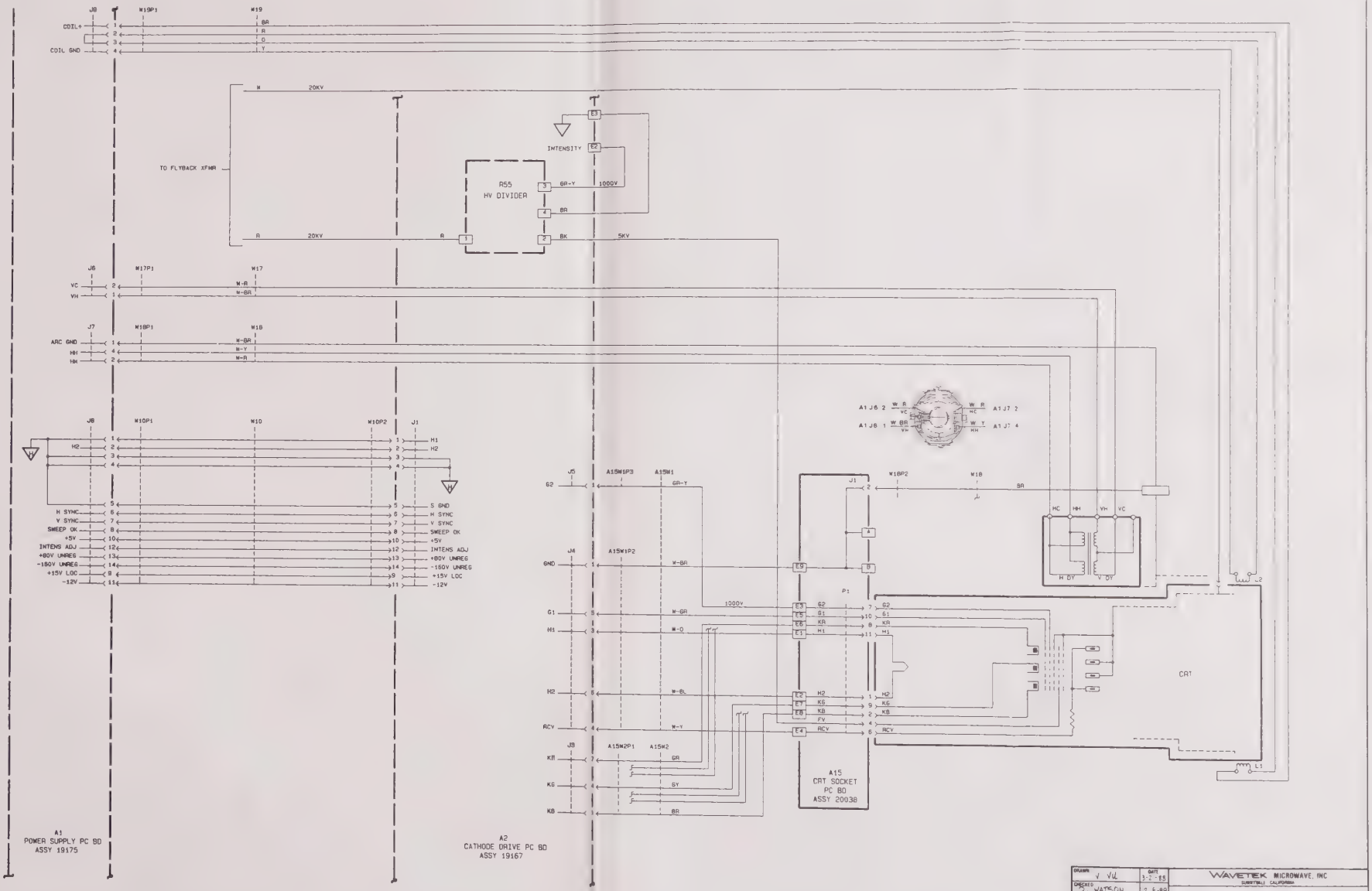
# SCHEMATIC DIAGRAMS (SD) AND ASSEMBLY DRAWINGS

(PC Board Component Part Locations)


| Reference Designation | | Drawing Number | Page Number |
|---|---|---|---|
| | Model 8003 Precision Scalar Analyzer SD (3 sheets) | 19525 | M3-3 |
| A1 | Power Supply PC Board Assy. Dwg. (Figure M3-1) | 19175 | M3-8 |
| | Power Supply PC Board SD (7 sheets) | 19176 | M3-9 |
| A2 | CRT Cathode PC Board Assy. Dwg. (Figure M3-2) | 19167 | M3-22 |
| | CRT Cathode PC Board SD | 19168 | M3-23 |
| A3 | Front Panel PC Board Assy. Dwg. (Figure M3-3) | 17228 | M3-24 |
| | Front Panel PC Board SD | 17229 | M3-25 |
| A4 | Analog Interconnect PC Board Assy. Dwg. (Figure M3-4) | 17231 | M3-26 |
| | Analog Interconnect PC Board SD (2 sheets) | 17232 | M3-27 |
| A5 | Calibrator PC Board Assy. Dwg. (Figure M3-5) | 17169 | M3-30 |
| | Calibrator PC Board SD (2 sheets) | 17170 | M3-31 |
| A6 | Analog PC Board Assy. Dwg. (Figure M3-6) | 17288 | M3-34 |
| | Analog PC Board SD (2 sheets) | 17289 | M3-35 |
| A9 | Digital Interconnect PC Board Assy. Dwg. (Figure M3-7) | 17707 | M3-38 |
| | Digital Interconnect PC Board SD (2 sheets) | 17708 | M3-39 |
| A10 | Peripheral/Memory PC Board Assy. Dwg. (Figure M3-8) | 17153 | M3-42 |
| | Peripheral/Memory PC Board SD (3 sheets) | 17154 | M3-43 |
| A11 | Graphics PC Board Assy. Dwg. (Figure M3-9) | 16922 | M3-48 |
| | Graphics PC Board SD (4 sheets) | 16923 | M3-49 |
| A12 | CPU PC Board Assy. Dwg. (Figure M3-10) | 16983 | M3-56 |
| | CPU PC Board SD (2 sheets) | 16984 | M3-57 |
| A13 | Rear Panel PC Board Assy. Dwg. (Figure M3-11) | 19142 | M3-60 |
| | Rear Panel PC Board SD (2 sheets) | 19143 | M3-61 |
| A14A1 | Modulator PC Board Assy. Dwg. (Figure M3-12) | 19943 | M3-64 |
| | Modulator PC Board SD (2 sheets) | 19944 | M3-65 |




| | | | |
|---|---|---|---|
| DRAWN | DATE 3-21-88 | WAVETEK MICROWAVE, INC. SUNNYVALE, CALIFORNIA | |
| CHECKED D WATSON | 12.8.89 | MODEL 6003 SCALAR NETWORK ANALYZER | |
| ENG G Torres | 12-11-89 | | |
| MFG APP'D H Lem | 12-7-89 | DRAWING NO 19525 | REV 10 |
| | | SHEET 1 OF 3 | |



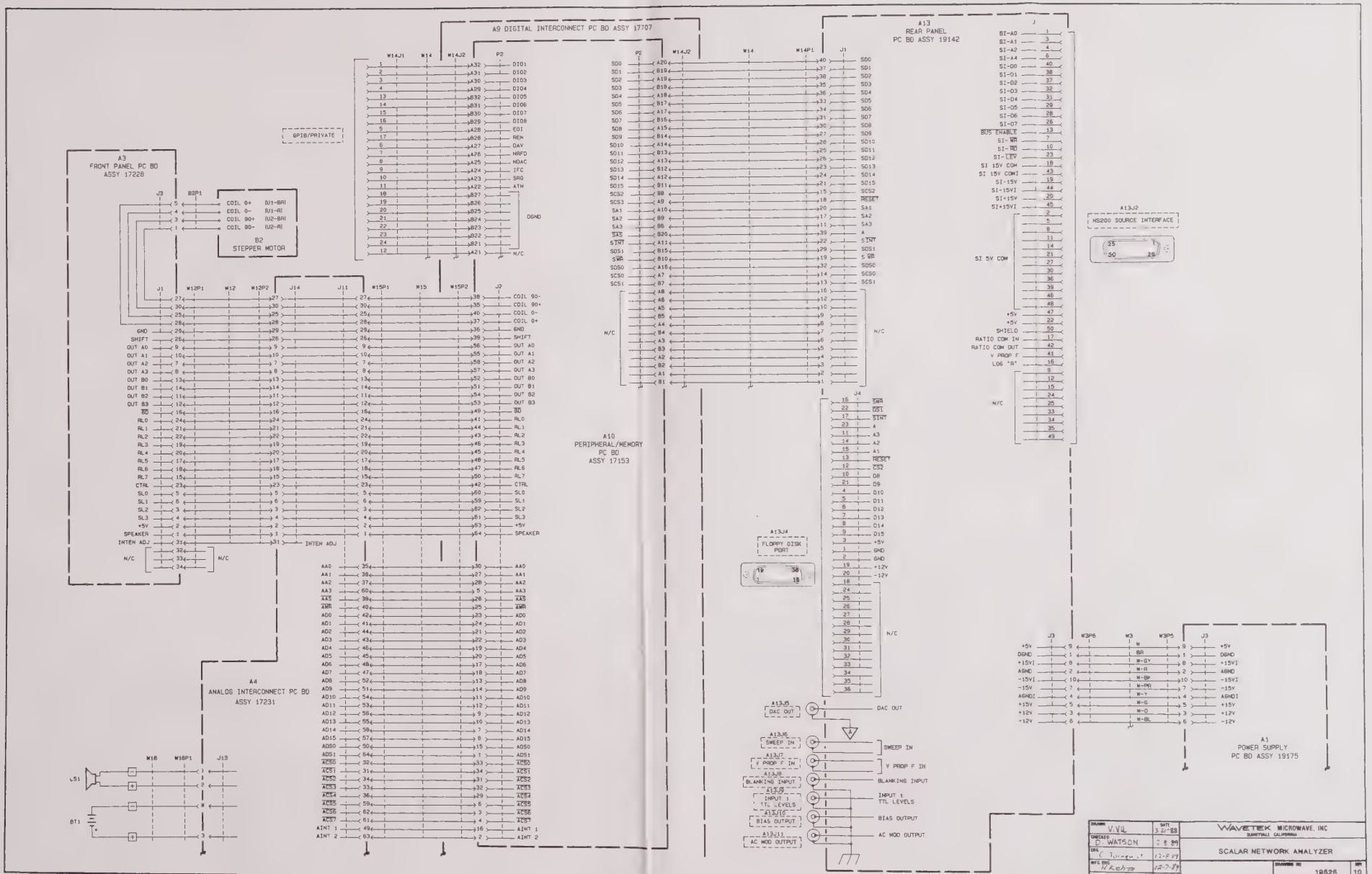

| | | | |
|---|---|---|---|
| DRAWN | V. VIL | DATE | 3-2-88 |
| CHECKED | D. WATSON | | 2-6-89 |
| ENG | J. TORREY | | 2-6-89 |
| MFG ENG | N. KEAN | | 12-7-88 |

WAVETEK MICROWAVE, INC
SUNNYVALE, CALIFORNIA

SCALAR NETWORK ANALYZER

19525 REV 10

SHEET 2 OF 3


A9 DIGITAL INTERCONNECT PC BD ASSY 17707
A13
REAR PANEL
PC BD ASSY 19142
A3
FRONT PANEL PC BD
ASSY 17228
GPIB/PRIVATE
B2
STEPPER MOTOR
COIL 0+
COIL 0-
COIL 90+
COIL 90-
A10
PERIPHERAL/MEMORY
PC BD
ASSY 17153
A4
ANALOG INTERCONNECT PC BD
ASSY 17231
A13J2
NS200 SOURCE INTERFACE
A13J4
FLOPPY DISK
PORT
A13J5
DAC OUT
A13J6
SWEEP IN
A13J7
V PROP F IN
A13J8
BLANKING INPUT
A13J9
INPUT 1
TTL LEVELS
A13J10
BIAS OUTPUT
A13J11
AC MOD OUTPUT
A1
POWER SUPPLY
PC BD ASSY 19175
WAVETEK MICROWAVE, INC
SCALAR NETWORK ANALYZER
19525
SHEET 3 OF 3

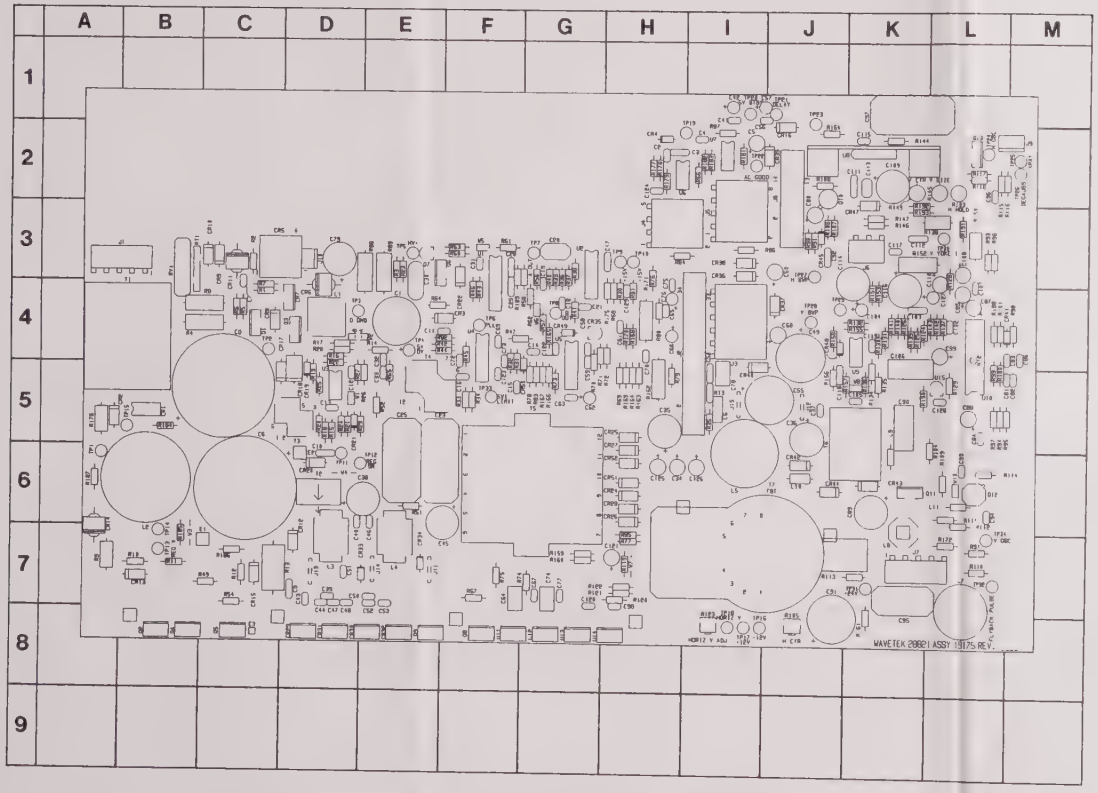
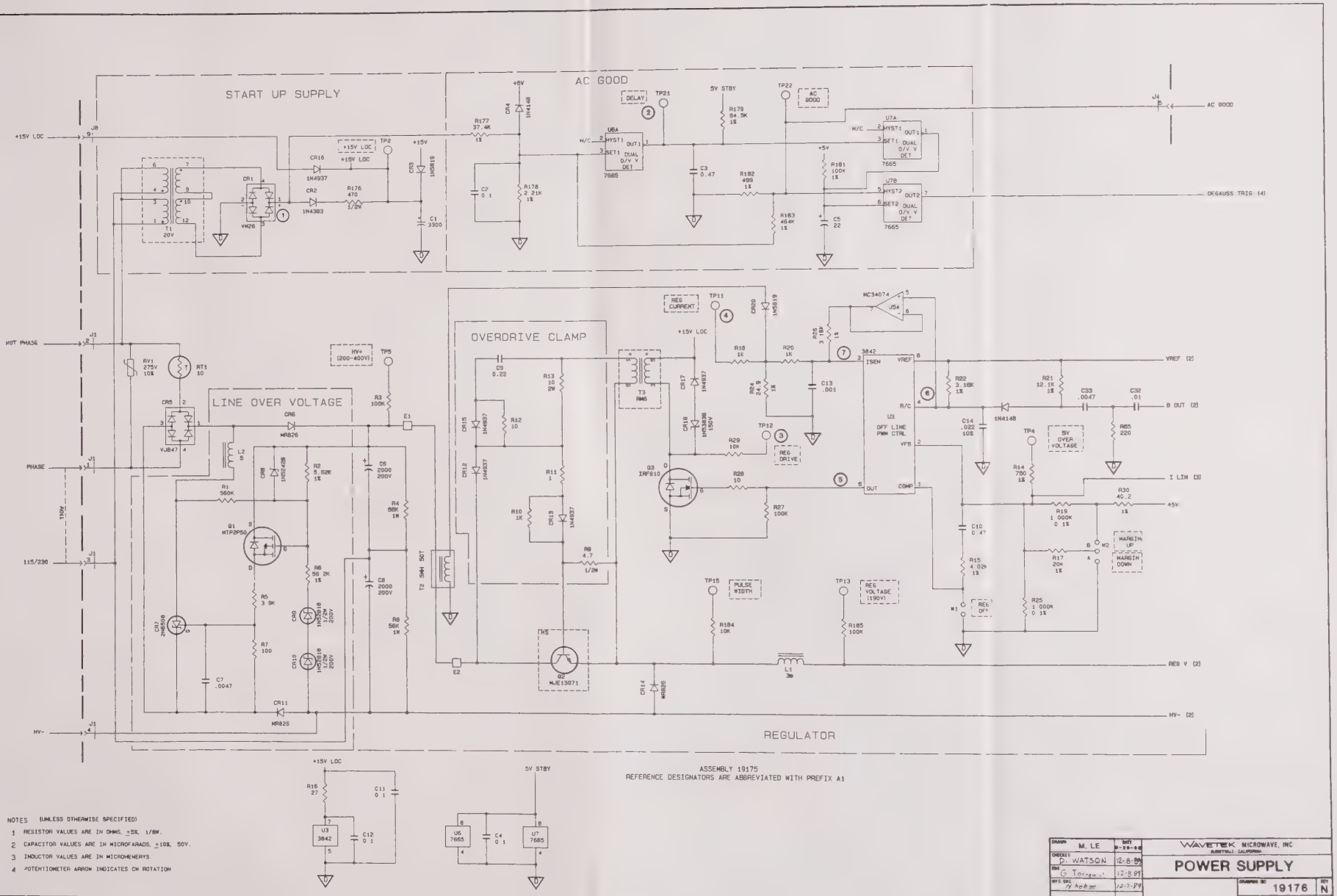



Figure M3-1 POWER SUPPLY PCB Assembly 19175

| CKT REF | GRID LOC |
|---|---|
| C1 | E-4 |
| C2 | H-2 |
| C3 | I-2 |
| C4 | I-2 |
| C5 | I-2 |
| C6 | C-5 |
| C7 | C-4 |
| C8 | C-4 |
| C9 | D-7 |
| C10 | D-6 |
| C11 | E-4 |
| C12 | D-5 |
| C13 | D-5 |
| C14 | G-4 |
| C15 | F-5 |
| C16 | F-5 |
| C17 | H-3 |
| C18 | G-4 |
| C19 | G-3 |
| C20 | G-3 |
| C21 | G-4 |
| C23 | E-5 |
| C25 | E-5 |
| C28 | F-3 |
| C29 | F-4 |
| C30 | E-3 |
| C31 | F-3 |
| C32 | E-4 |
| C33 | E-5 |
| C34 | H-6 |
| C35 | H-5 |
| C36 | J-5 |
| C37 | J-5 |
| C38 | E-6 |
| C39 | D-7 |
| C40 | D-7 |
| C41 | J-1 |
| C42 | J-1 |
| C43 | D-7 |
| C44 | D-7 |
| C45 | F-7 |
| C46 | E-7 |
| C47 | D-7 |
| C48 | D-7 |
| C49 | J-4 |
| C50 | D-7 |
| C51 | D-7 |
| C52 | E-7 |
| C53 | E-7 |
| C54 | I-4 |
| C55 | J-5 |
| C56 | I-1 |
| C57 | I-1 |
| C58 | G-4 |
| C59 | G-5 |
| C60 | J-3 |
| C61 | H-4 |
| C62 | G-5 |
| C63 | G-5 |
| C64 | F-7 |
| C65 | H-4 |
| C66 | H-4 |
| C67 | G-7 |
| C68 | J-4 |
| C69 | F-4 |
| C70 | H-5 |
| C72 | F-4 |
| C73 | F-4 |
| C74 | G-7 |
| C75 | H-3 |
| C76 | H-4 |
| C77 | G-7 |
| C78 | I-5 |
| C79 | D-3 |
| C80 | J-2 |
| C81 | L-5 |
| C82 | L-5 |
| C83 | M-4 |
| C84 | L-5 |
| C85 | L-4 |
| C86 | M-4 |
| C87 | L-4 |
| C88 | L-5 |
| C89 | K-6 |
| C90 | K-5 |
| C91 | J-7 |
| C92 | J-3 |
| C93 | L-6 |
| C94 | L-6 |
| C95 | K-7 |
| C96 | L-2 |
| C97 | K-1 |
| C98 | H-7 |
| C99 | L-4 |
| C102 | L-4 |
| C103 | K-4 |
| C104 | K-4 |
| C105 | K-5 |
| C106 | K-4 |
| C107 | L-4 |
| C108 | L-3 |
| C109 | K-2 |
| C110 | L-3 |
| C111 | K-2 |
| C112 | K-3 |
| C113 | K-2 |
| C114 | K-3 |
| C115 | K-2 |
| C116 | K-4 |
| C117 | K-3 |
| C118 | J-5 |
| C119 | K-4 |
| C120 | G-7 |
| C121 | H-7 |
| C122 | G-4 |
| C123 | F-5 |
| C124 | H-2 |
| C125 | H-6 |
| C126 | I-6 |
| C127 | L-4 |
| C128 | L-5 |
| C129 | H-4 |
| CR1 | B-5 |
| CR2 | A-5 |
| CR3 | F-4 |
| CR4 | H-2 |
| CR5 | C-3 |
| CR6 | D-4 |
| CR7 | D-4 |
| CR8 | C-4 |
| CR9 | C-3 |
| CR10 | C-3 |
| CR11 | C-3 |
| CR12 | D-7 |
| CR13 | B-7 |
| CR14 | A-7 |
| CR15 | C-7 |
| CR16 | J-2 |
| CR17 | C-4 |
| CR18 | D-5 |
| CR19 | D-5 |
| CR20 | D-6 |
| CR21 | D-5 |
| CR22 | F-4 |
| CR24 | H-6 |
| CR25 | H-5 |
| CR26 | H-6 |
| CR27 | H-5 |
| CR28 | H-6 |
| CR29 | D-8 |
| CR30 | D-8 |
| CR31 | D-8 |
| CR32 | E-8 |
| CR33 | D-7 |
| CR34 | E-7 |
| CR35 | G-4 |
| CR36 | I-3 |
| CR37 | J-4 |
| CR38 | I-3 |
| CR39 | J-2 |
| CR40 | I-5 |
| CR41 | L-4 |
| CR42 | J-6 |
| CR43 | K-6 |
| CR44 | J-6 |
| CR45 | J-3 |
| CR47 | K-3 |
| CR48 | J-4 |
| CR49 | G-4 |
| CR50 | G-5 |
| CR51 | H-6 |
| CR52 | H-6 |
| J1 | B-3 |
| J2 | H-4 |
| J3 | I-4 |
| J4 | H-3 |
| J5 | I-3 |
| J6 | K-3 |
| J7 | K-7 |
| J8 | J-2 |
| J9 | M-2 |
| J10 | D-3 |
| J11 | E-7 |
| J12 | J-5 |
| J13 | D-7 |
| J14 | E-7 |
| J15 | I-5 |
| L1 | D-4 |
| L2 | B-7 |
| L3 | D-7 |
| L4 | E-7 |
| L5 | I-6 |
| L6 | I-5 |
| L7 | L-7 |
| L8 | K-7 |
| L9 | K-5 |
| L10 | J-6 |
| L11 | L-6 |
| Q1 | C-4 |
| Q2 | B-8 |
| Q3 | D-4 |
| Q4 | B-8 |
| Q5 | C-8 |
| Q6 | F-3 |
| Q7 | E-3 |
| Q8 | F-8 |
| Q9 | E-8 |
| Q10 | J-2 |
| Q11 | K-6 |
| Q12 | L-6 |
| Q13 | L-2 |
| R1 | C-4 |
| R2 | C-3 |
| R3 | E-3 |
| R4 | C-4 |
| R5 | C-4 |
| R6 | C-4 |
| R7 | C-4 |
| R8 | C-4 |
| R9 | A-7 |
| R10 | B-7 |
| R11 | B-7 |
| R12 | C-7 |
| R13 | D-7 |
| R14 | E-4 |
| R15 | D-5 |
| R16 | D-4 |
| R17 | D-4 |
| R18 | D-5 |
| R19 | D-5 |
| R20 | D-5 |
| R21 | D-5 |
| R22 | D-5 |
| R23 | E-3 |
| R24 | D-5 |
| R25 | D-5 |
| R26 | E-5 |
| R27 | D-5 |
| R28 | D-4 |
| R29 | E-5 |
| R30 | H-4 |
| R31 | F-4 |
| R32 | F-4 |
| R33 | F-5 |
| R34 | F-5 |
| R35 | I-5 |
| R36 | G-3 |
| R37 | G-3 |
| R38 | G-3 |
| R39 | G-3 |
| R40 | G-3 |
| R41 | G-4 |
| R42 | E-4 |
| R43 | F-4 |
| R44 | E-4 |
| R45 | F-4 |
| R46 | F-4 |
| R47 | F-4 |
| R49 | C-7 |
| R51 | E-6 |
| R52 | E-5 |
| R54 | C-7 |
| R56 | G-3 |
| R57 | G-4 |
| R58 | G-4 |
| R60 | F-3 |
| R61 | F-3 |
| R62 | G-4 |
| R63 | F-3 |
| R64 | E-4 |
| R65 | E-5 |
| R66 | I-2 |
| R67 | F-7 |
| R68 | H-4 |
| R69 | H-4 |
| R70 | G-5 |
| R71 | G-5 |
| R72 | H-5 |
| R73 | G-5 |
| R74 | G-7 |
| R75 | F-7 |
| R76 | H-3 |
| R77 | H-7 |
| R78 | G-5 |
| R79 | H-5 |
| R80 | H-4 |
| R81 | H-4 |
| R82 | E-4 |
| R83 | G-5 |
| R84 | H-3 |
| R85 | H-7 |
| R86 | I-3 |
| R87 | I-2 |
| R88 | E-3 |
| R89 | E-3 |
| R90 | J-3 |
| R91 | J-3 |
| R92 | L-7 |
| R93 | L-3 |
| R94 | L-5 |
| R95 | L-5 |
| R96 | L-3 |
| R97 | L-5 |
| R98 | M-4 |
| R99 | L-5 |
| R100 | L-5 |
| R101 | L-4 |
| R103 | L-2 |
| R104 | L-6 |
| R105 | J-8 |
| R106 | J-3 |
| R107 | J-3 |
| R108 | J-2 |
| R109 | L-6 |
| R110 | L-7 |
| R111 | L-6 |
| R112 | L-6 |
| R113 | J-7 |
| R114 | L-6 |
| R115 | L-2 |
| R116 | L-2 |
| R117 | L-2 |
| R118 | L-2 |
| R119 | H-7 |
| R120 | H-7 |
| R121 | H-7 |
| R122 | H-7 |
| R123 | I-8 |
| R124 | K-4 |
| R125 | K-4 |
| R126 | K-4 |
| R128 | L-3 |
| R129 | L-5 |
| R130 | K-4 |
| R131 | K-4 |
| R132 | K-4 |
| R134 | K-5 |
| R135 | K-5 |
| R136 | K-5 |
| R137 | L-4 |
| R138 | K-3 |
| R139 | K-4 |
| R140 | K-4 |
| R141 | K-4 |
| R142 | L-4 |
| R143 | K-4 |
| R144 | K-2 |
| R145 | L-2 |
| R146 | K-3 |
| R147 | K-3 |
| R149 | K-2 |
| R150 | L-3 |
| R151 | K-4 |
| R152 | K-3 |
| R153 | K-4 |
| R154 | J-2 |
| R155 | K-4 |
| R156 | J-5 |
| R157 | J-5 |
| R158 | J-4 |
| R159 | G-7 |
| R160 | G-7 |
| R161 | K-8 |
| R162 | H-5 |
| R163 | H-5 |
| R164 | H-5 |
| R165 | G-4 |
| R166 | G-5 |
| R167 | G-5 |
| R168 | H-4 |
| R169 | H-4 |
| R170 | H-4 |
| R171 | H-4 |
| R172 | L-7 |
| R175 | H-4 |
| R176 | A-5 |
| R177 | H-2 |
| R178 | H-2 |
| R179 | H-2 |
| R181 | I-2 |
| R182 | I-2 |
| R183 | I-2 |
| R184 | B-5 |
| R185 | B-7 |
| R186 | C-7 |
| R187 | A-6 |
| R188 | L-4 |
| R189 | F-4 |
| R190 | K-5 |
| R191 | L-3 |
| R192 | K-3 |
| R193 | K-3 |
| RT1 | B-3 |
| RT2 | L-4 |
| RT3 | I-5 |
| RV1 | B-3 |
| T1 | B-4 |
| T2 | D-6 |
| T3 | D-5 |
| T4 | E-4 |
| T5 | G-5 |
| T6 | J-5 |
| T7 | J-6 |
| TP1 | A-6 |
| TP2 | C-4 |
| TP3 | D-4 |
| TP4 | E-4 |
| TP5 | E-3 |
| TP6 | F-4 |
| TP7 | G-3 |
| TP8 | G-4 |
| TP9 | H-3 |
| TP10 | H-3 |
| TP11 | D-6 |
| TP12 | E-6 |
| TP13 | B-7 |
| TP14 | B-7 |
| TP15 | B-5 |
| TP16 | I-8 |
| TP17 | I-8 |
| TP18 | I-8 |
| TP19 | I-2 |
| TP20 | I-1 |
| TP21 | J-1 |
| TP22 | I-2 |
| TP23 | J-1 |
| TP24 | L-2 |
| TP25 | M-2 |
| TP26 | M-2 |
| TP27 | J-3 |
| TP28 | J-4 |
| TP29 | J-4 |
| TP30 | L-3 |
| TP31 | K-7 |
| TP32 | L-7 |
| TP33 | F-5 |
| TP34 | L-7 |
| U1 | F-3 |
| U2 | G-3 |
| U3 | D-5 |
| U4 | F-4 |
| U5 | G-5 |
| U6 | H-2 |
| U7 | I-2 |
| U8 | K-2 |
| U9 | K-4 |
| U10 | L-5 |
| U11 | F-8 |
| U12 | G-8 |
| U13 | G-8 |
| U14 | G-8 |
| U15 | L-5 |
| W1 | D-5 |
| W2 | E-4 |
| W3 | B-7 |
| W4 | D-6 |
| W5 | H-7 |
| W6 | K-5 |
| W7 | L-6 |
| W8 | |
| W10 | |
| W11 | |
| XQ11 | |

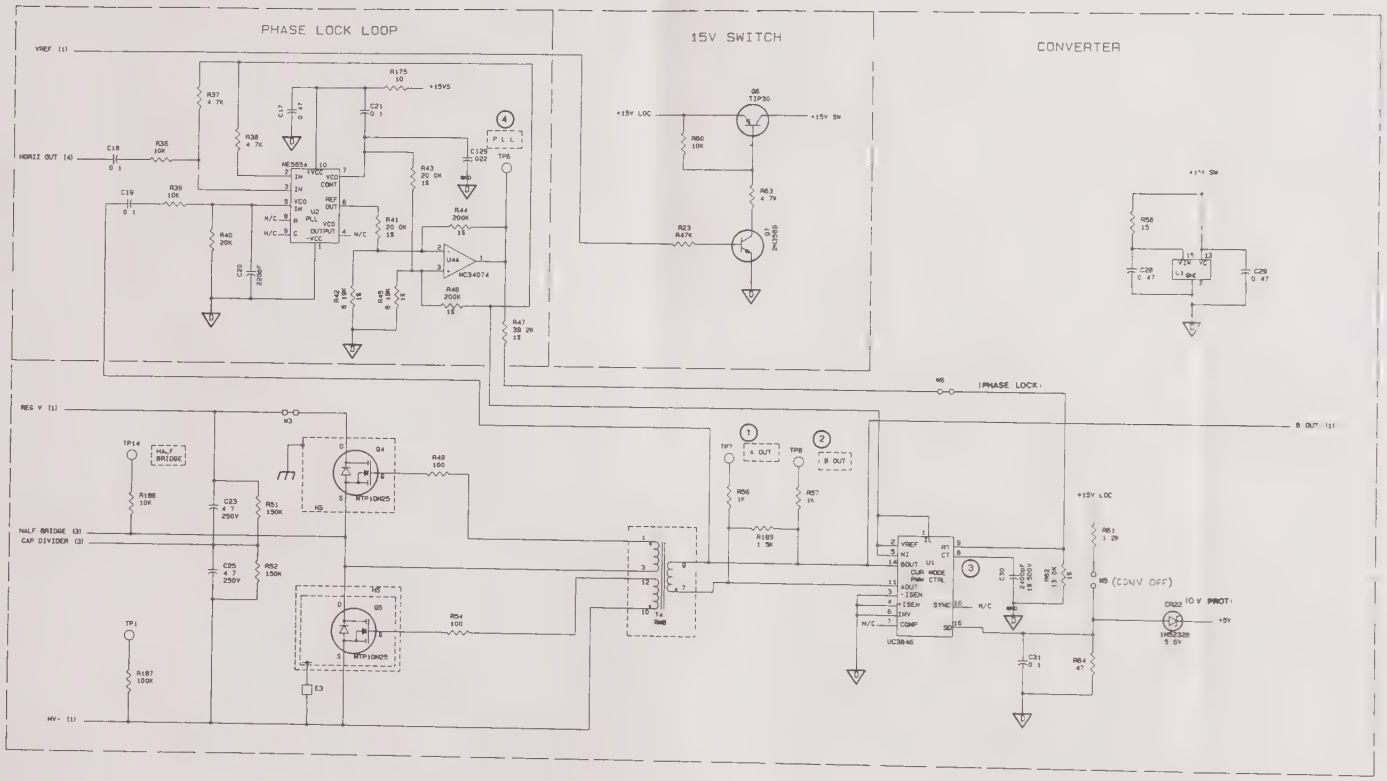



NOTES (UNLESS OTHERWISE SPECIFIED)

1. RESISTOR VALUES ARE IN OHMS, ±5%, 1/8W.
2. CAPACITOR VALUES ARE IN MICROFARADS, ±10%, 50V.
3. INDUCTOR VALUES ARE IN MICROHENERYS
4. POTENTIOMETER ARROW INDICATES CW ROTATION

| | | |
|---|---|---|
| DRAWN M. LE | DATE 12-8-89 | WAVETEK MICROWAVE, INC. SUNNYVALE, CALIFORNIA |
| CHECKED D. WATSON | 12-8-89 | POWER SUPPLY |
| ENG G Torgan | 12-8-89 | DRAWING NO. 19176 REV N |
| MFG ENG M Nelson | 12-7-89 | SHEET 1 OF 7 |

M3-9

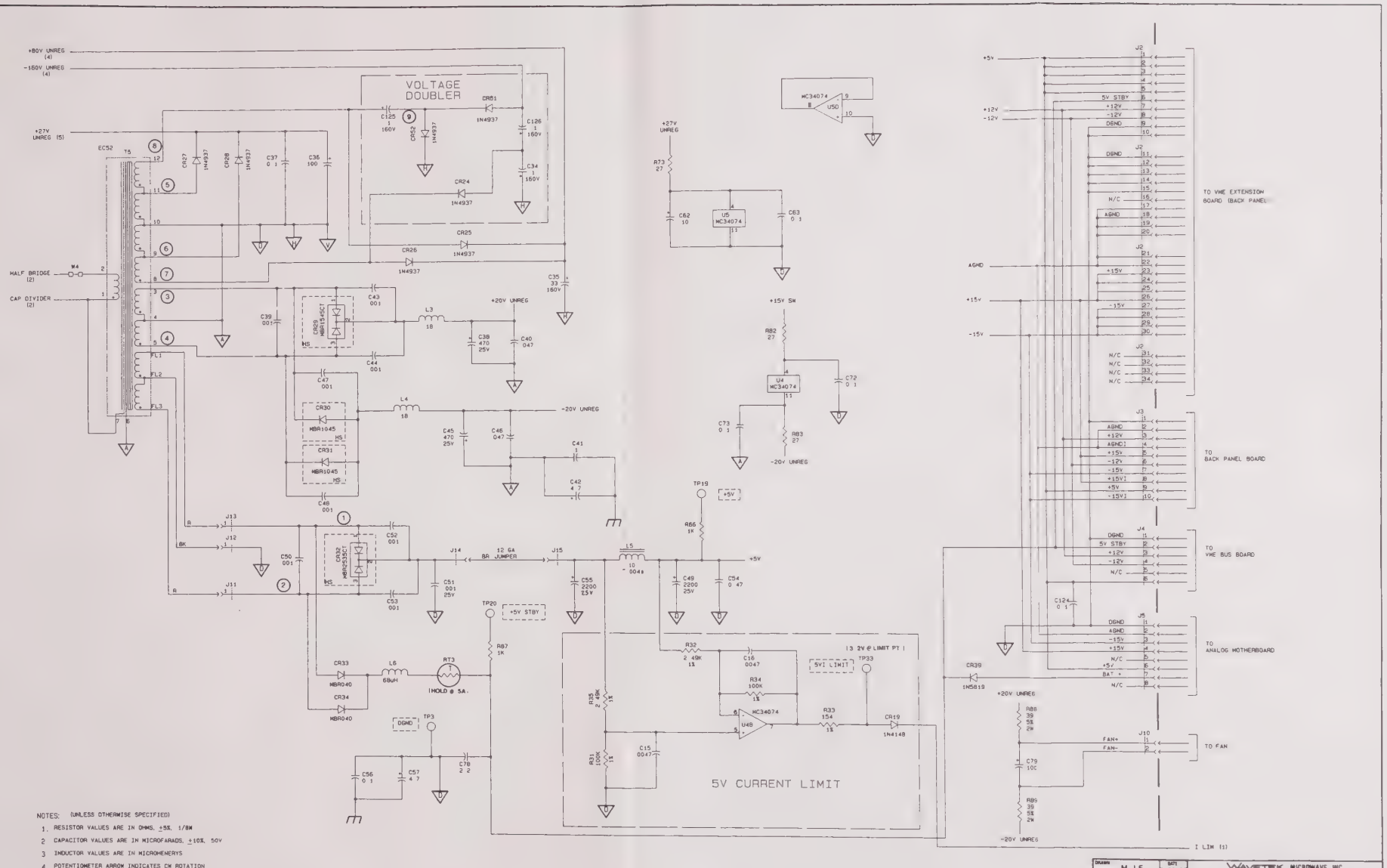



NOTES. UNLESS OTHERWISE SPECIFIED

1. RESISTOR VALUES ARE IN OHMS, ±5%, 1/8W.
2. CAPACITOR VALUES ARE IN MICROFARADS, ±10%, 50V.
3. INDUCTOR VALUES ARE IN MICROHENERYS.
4. POTENTIOMETER ARROW INDICATES CW ROTATION

| | | | |
|---|---|---|---|
| DRAWN M. LE | DATE 8-28-89 | WAVETEK MICROWAVE, INC | |
| CHECKED D WATSON | 9-8-89 | POWER SUPPLY | |
| ENG C Torrguson | 12-5-89 | | |
| MFG ENG | 12-7-89 | DRAWING NO 19176 | REV N |
| | | SHEET 2 OF 7 | |

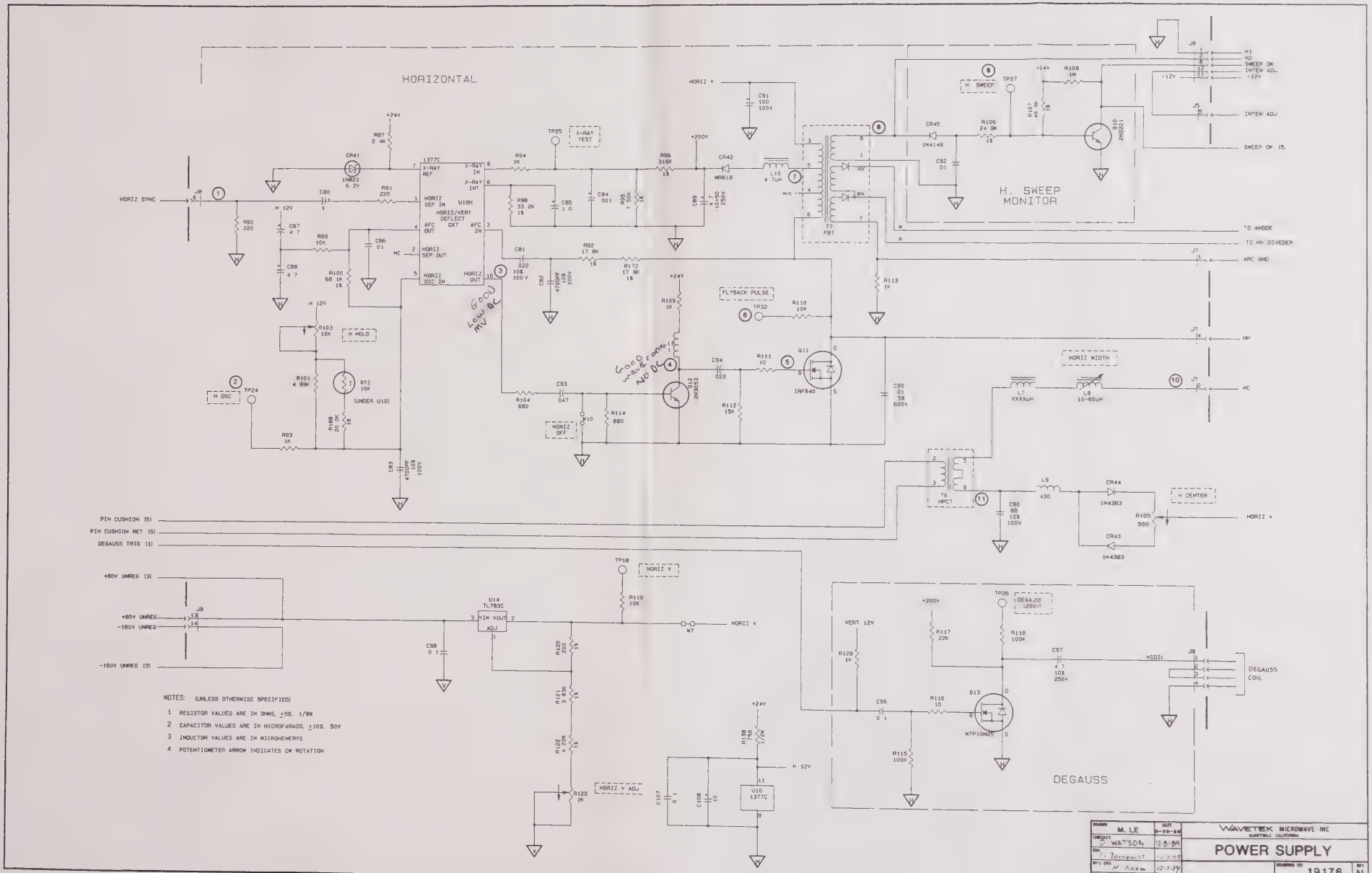
M3-11




NOTES: (UNLESS OTHERWISE SPECIFIED)

1. RESISTOR VALUES ARE IN OHMS, ±5%, 1/8W
2. CAPACITOR VALUES ARE IN MICROFARADS, ±10%, 50V
3. INDUCTOR VALUES ARE IN MICROHENERYS
4. POTENTIOMETER ARROW INDICATES CW ROTATION

| | | |
|---|---|---|
| DRAWN M. LE | DATE 8-28-89 | WAVETEK MICROWAVE, INC. SUBMITTALE, CALIFORNIA |
| CHECKED P. WATSON | 12-8-89 | POWER SUPPLY |
| ENG C. Tornquist | 1-18-89 | DRAWING NO 19176 REV N |
| MFG ENG ~ Evans | 12-89 | SHEET 3 OF 7 |

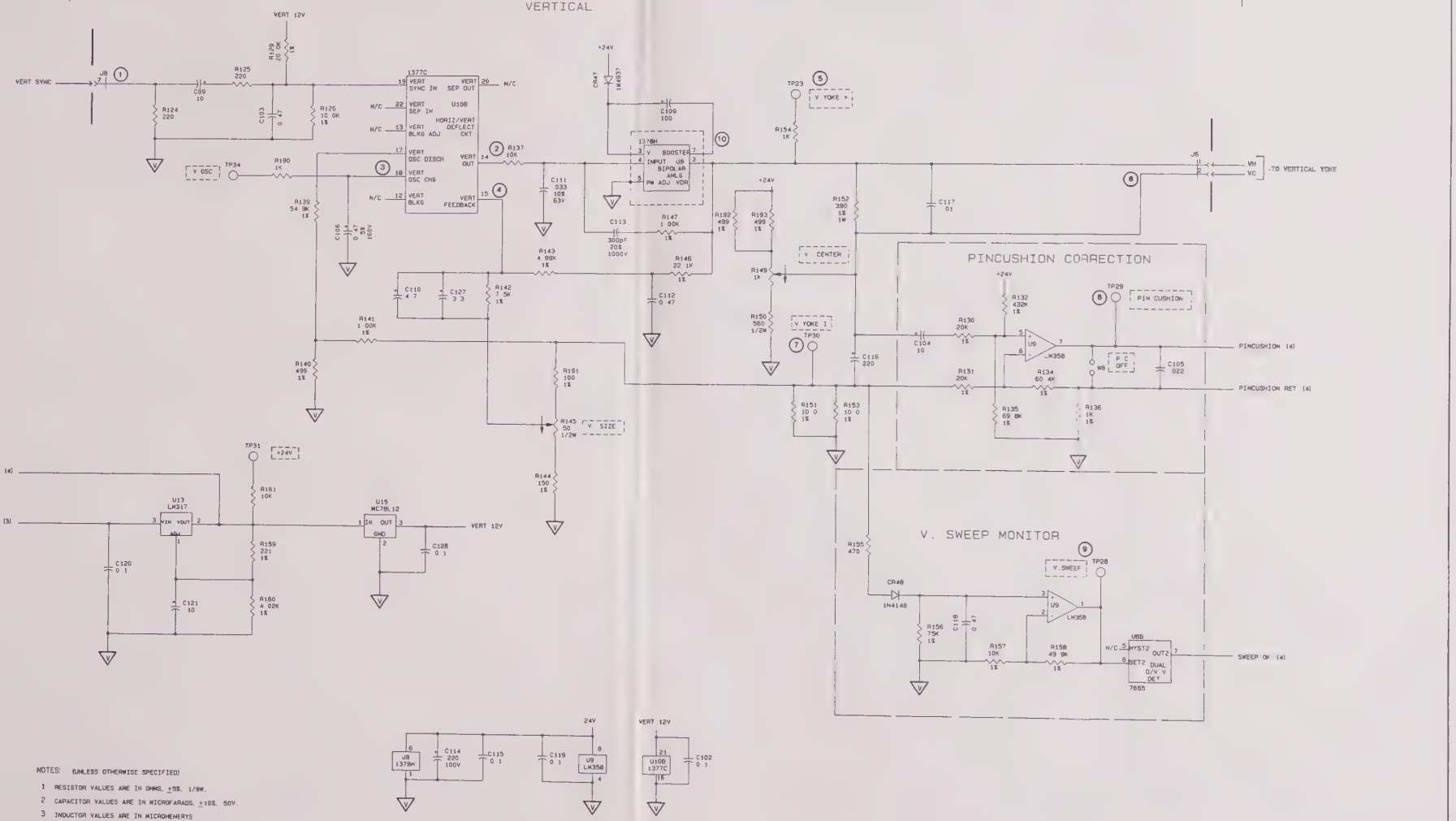



| | | |
|---|---|---|
| DRAWN | M. LE | DATE 9-26-89 |
| CHECKED | D. WATSON | 12-8-89 |
| ENG | J. Tirrquist | 12-7-89 |
| MFG ENG | M. Kamm | 12-7-89 |

WAVETEK MICROWAVE INC
SUNNYVALE CALIFORNIA

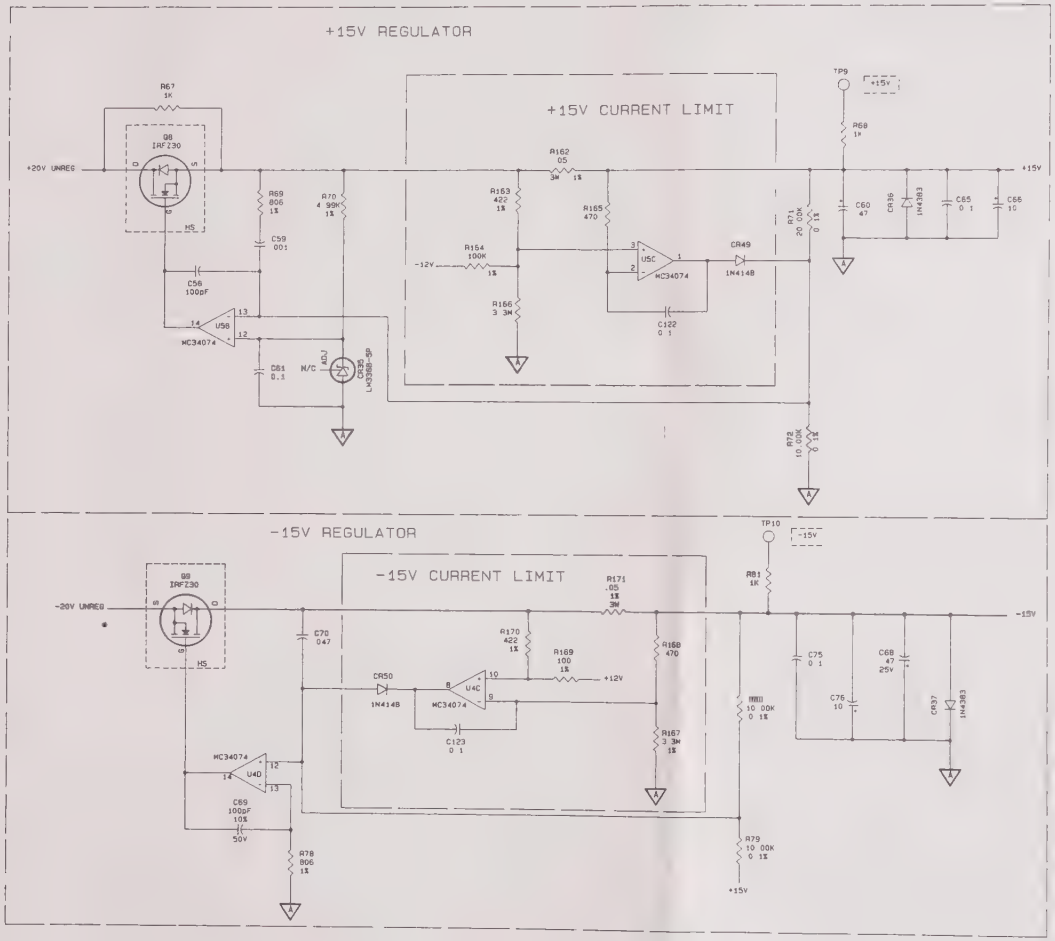
# POWER SUPPLY

DRAWING NO 19176 REV N
SHEET 4 OF 7




| | | | |
|---|---|---|---|
| DRAWN | M. LE | DATE | WAVETEK MICROWAVE, INC. |
| CHECKED | D. WATSON | | POWER SUPPLY |
| ENG | | | DRAWING NO 19176 REV N |
| MFG ENG | | | SHEET 5 OF 7 |

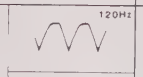
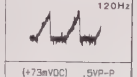
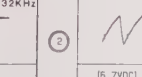
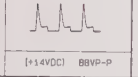
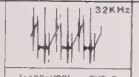
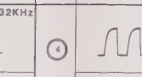
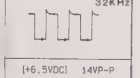
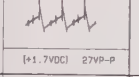
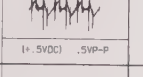
M3-17



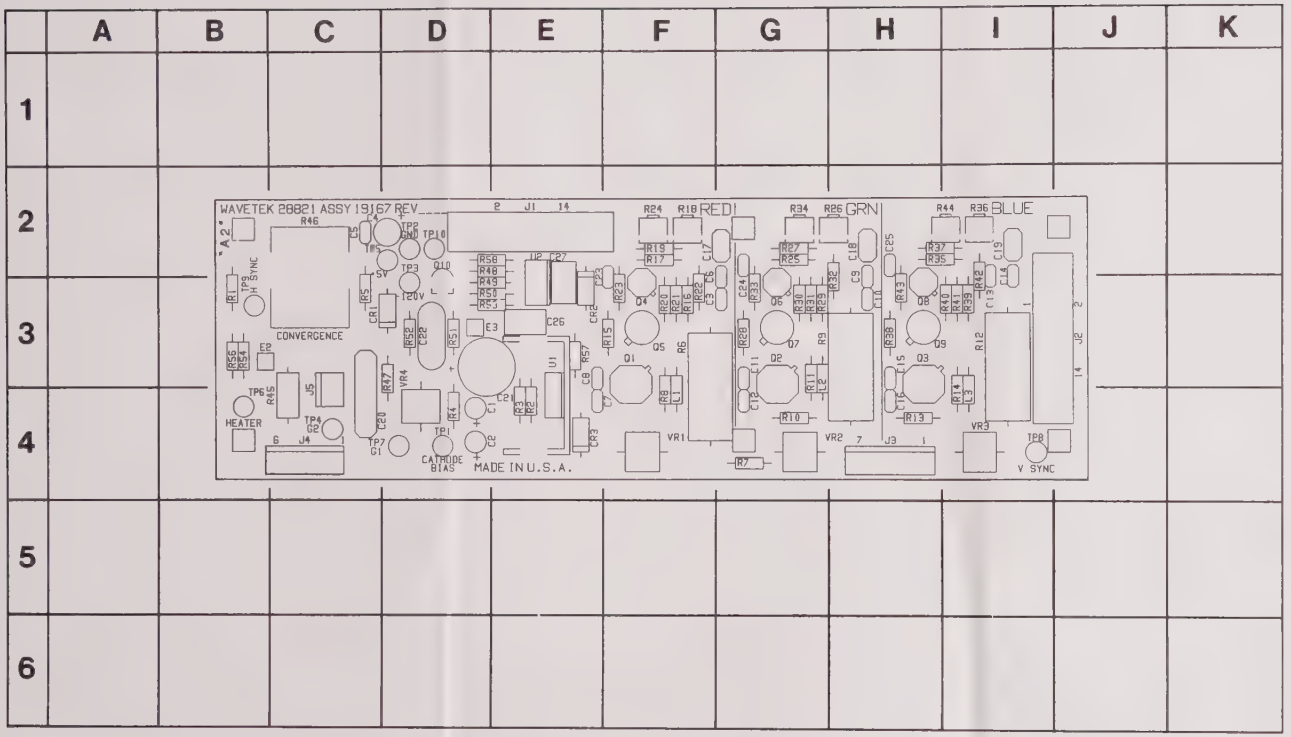

NOTES (UNLESS OTHERWISE SPECIFIED)

1 RESISTOR VALUES ARE IN OHMS, ±5%, 1/8W
2 CAPACITOR VALUES ARE IN MICROFARADS, ±10%, 50V
3 INDUCTOR VALUES ARE IN MICROHENERYS
4 POTENTIOMETER ARROW INDICATES CW ROTATION

| | | | |
|---|---|---|---|
| DRAWN M. LE | DATE 8-29-89 | WAVETEK MICROWAVE INC SUNRTVALE, CALIFORNIA | |
| CHECKED D. WATSON | 12-8-89 | POWER SUPPLY | |
| ENG G. Tomyasu | 12-8-89 | | |
| MFG ENG M. Hebert | 12-7-89 | 19176 | REV N |
| | | SHEET 8 OF 7 | |

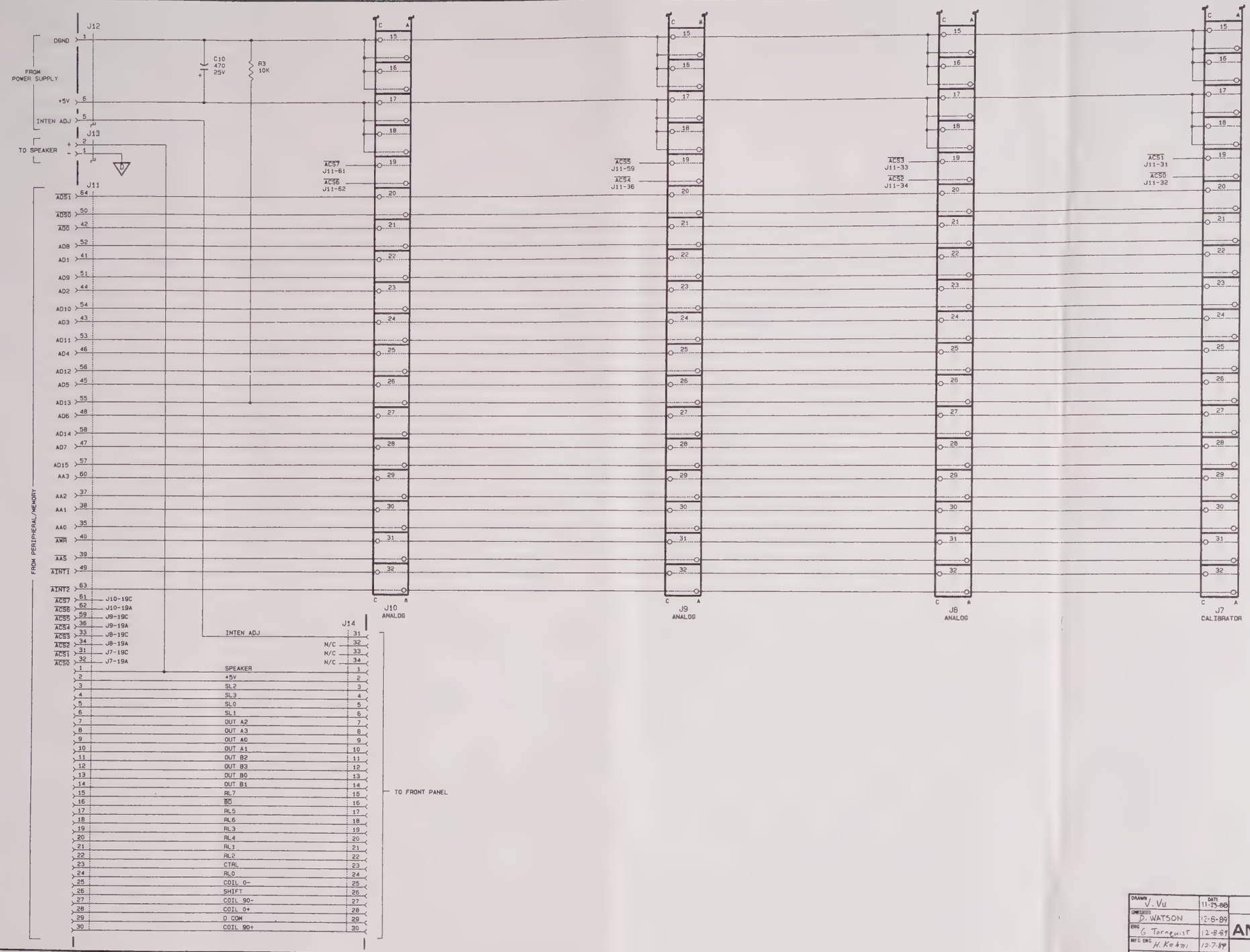
| | SHEET 1 | SHEET 2 | SHEET 3 | SHEET 4 | SHEET 5 |
|---|---|---|---|---|---|
| 1 |  120Hz (+22VDC) 34VP-P | 32KHz (+5.9VDC) 13VP-P |  32KHz 12VP-P |  32KHz (3.1VDC) 3.5VP-P |  60Hz (1VDC) 3.5VP-P |
| 2 |  120Hz (+73mVDC) .5VP-P |  32KHz (+5.9VDC) 13VP-P |  32KHz 12VP-P |  32KHz (6.7VDC) 4.5VP-P |  60Hz (1.2VDC) 3.6VP-P |
| 3 |  32KHz (+14VDC) 88VP-P | 32KHz (+2VDC) 17VP-P |  32KHz 42VP-P |  32KHz (2.4VDC) 5VP-P |  60Hz (6.3VDC) 2.8VP-P |
| 4 |  32KHz (+100mVDC) .5VP-P |  32KHz (+5.9VDC) .5VP-P |  32KHz 42VP-P |  32KHz (10.8VDC) 24VP-P |  60Hz (2.7VDC) 1.5VP-P |
| 5 |  32KHz (+6.5VDC) 14VP-P | |  32KHz 65VP-P |  32KHz (-30mVDC) 20VP-P |  60Hz (13VDC) 64VP-P |
| 6 |  32KHz (+1.7VDC) 27VP-P | |  32KHz 65VP-P |  32KHz (60VDC) 370VP-P |  60Hz (13VDC) 6.4VP-P |
| 7 |  32KHz (+.5VDC) .5VP-P | |  32KHz 163VP-P |  32KHz (+60VDC) 200VP-P |  60Hz (-50mVDC) 27VP-P |
| 8 | | |  32KHz 163VP-P |  32KHz (-30mVDC) 20VP-P |  60Hz (13VDC) 17VP-P |
| 9 | | |  32KHz 181VP-P |  32KHz (-1.1VDC) 1.1VP-P |  60Hz (3.5VDC) 2.6VP-P |
| 10 | | | |  32KHz (+60VDC) 27VP-P |  60Hz (1.4VDC) 24VP-P |
| 11 | | | | 32KHz (+60VDC) 5.9VP-P | |

| | | | |
|---|---|---|---|
| DRAWN M LE | DATE 3-29-88 | WAVETEK MICROWAVE INC SUNTRALL CALIFORNIA | |
| CHECKED P. WATSON | 12-8-89 | POWER SUPPLY | |
| ENG T. Tanguay | 12-8-89 | | |
| MFG ENG M Adam | 12-7-89 | DRAWING NO 19176 | REV N |
| | | SHEET 7 OF 7 | |

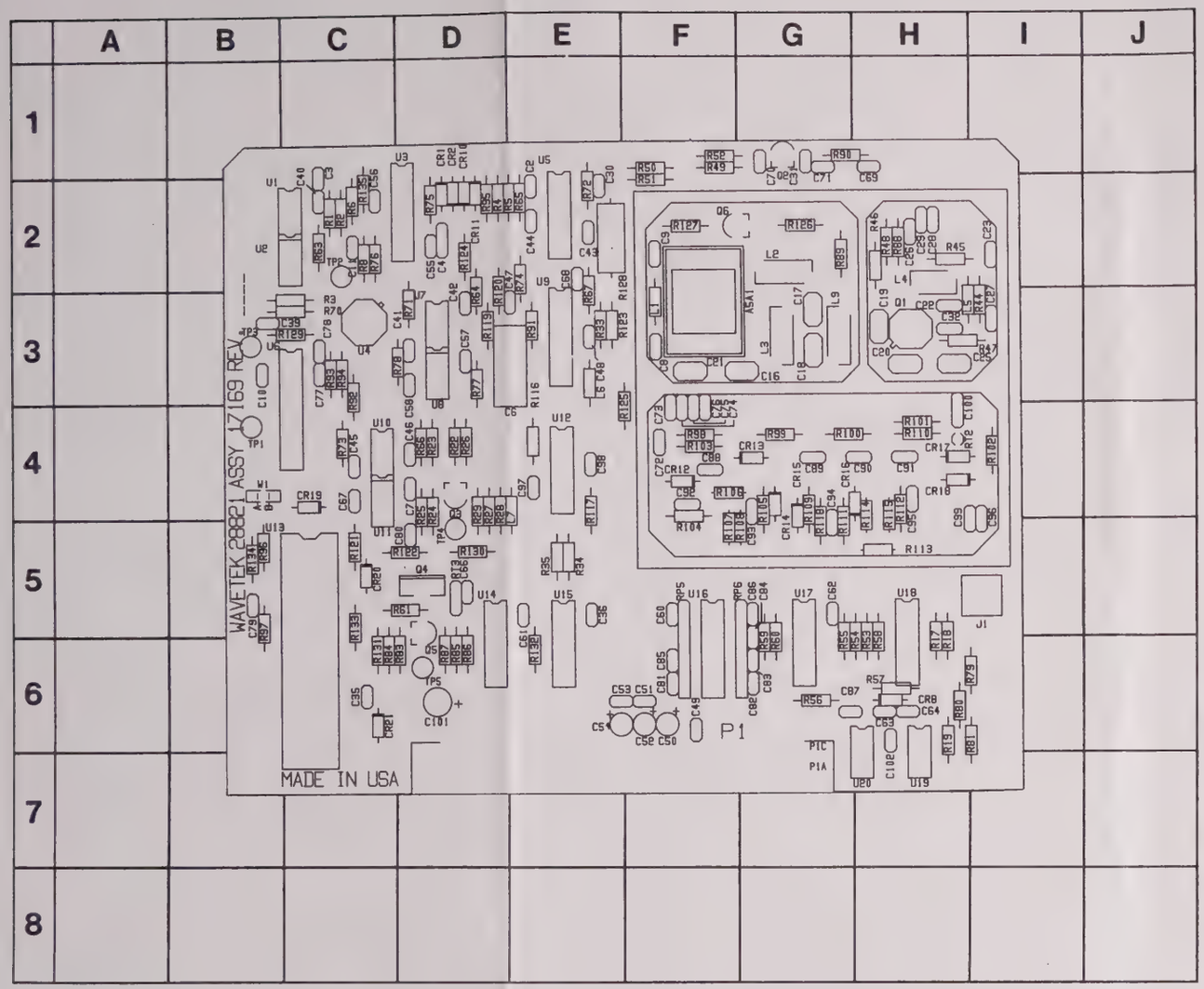



| CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC |
|---|---|---|---|---|---|---|---|---|---|
| C1 | D-4 | E1 | | R7 | G-4 | R42 | I-2 | VR1 | F-4 |
| C2 | D-4 | E2 | B-3 | R8 | F-4 | R43 | H-3 | VR2 | G-4 |
| C3 | G-3 | E3 | D-3 | R9 | H-3 | R44 | I-2 | VR3 | I-4 |
| C4 | D-2 | | | R10 | G-4 | R45 | C-4 | VR4 | D-4 |
| C5 | C-2 | | | R11 | G-3 | R46 | C-2 | | |
| C6 | G-3 | J1 | E-2 | R12 | I-3 | R47 | D-3 | | |
| C7 | E-4 | J2 | J-3 | R13 | H-4 | R48 | E-2 | | |
| C8 | E-3 | J3 | H-4 | R14 | I-4 | R49 | E-3 | | |
| C9 | H-3 | J4 | C-4 | R15 | F-3 | R50 | E-3 | | |
| C10 | H-3 | J5 | C-4 | R16 | F-3 | R51 | D-3 | | |
| C11 | G-3 | | | R17 | F-2 | R52 | D-3 | | |
| C12 | G-4 | | | R18 | F-2 | R53 | E-3 | | |
| C13 | I-3 | L1 | F-4 | R19 | F-2 | R54 | B-3 | | |
| C14 | I-3 | L2 | G-4 | R20 | F-3 | R55 | | | |
| C15 | H-3 | L3 | I-4 | R21 | F-3 | R56 | B-3 | | |
| C16 | H-4 | | | R22 | F-3 | R57 | E-3 | | |
| C17 | G-2 | | | R23 | F-3 | R58 | E-2 | | |
| C18 | H-2 | Q1 | F-3 | R24 | F-2 | | | | |
| C19 | I-2 | Q2 | G-3 | R25 | G-2 | | | | |
| C20 | C-4 | Q3 | H-3 | R26 | H-2 | | | | |
| C21 | D-3 | Q4 | F-3 | R27 | G-2 | TP1 | D-4 | | |
| C22 | D-3 | Q5 | F-3 | R28 | G-3 | TP2 | D-2 | | |
| C23 | F-3 | Q6 | G-3 | R29 | G-3 | TP3 | D-3 | | |
| C24 | G-2 | Q7 | G-3 | R30 | G-3 | TP4 | C-4 | | |
| C25 | H-2 | Q8 | H-3 | R31 | G-3 | TP5 | D-2 | | |
| C26 | E-3 | Q9 | H-3 | R32 | H-2 | TP6 | B-4 | | |
| C27 | E-3 | Q10 | D-3 | R33 | G-3 | TP7 | D-4 | | |
| | | | | R34 | G-2 | TP8 | I-4 | | |
| | | | | R35 | I-2 | TP9 | B-3 | | |
| | | R1 | B-3 | R36 | I-2 | TP10 | D-2 | | |
| CR1 | D-3 | R2 | E-4 | R37 | I-2 | | | | |
| CR2 | E-3 | R3 | E-4 | R38 | H-3 | | | | |
| CR3 | E-4 | R4 | D-4 | R39 | I-3 | U1 | E-4 | | |
| | | R5 | C-3 | R40 | I-3 | U2 | E-3 | | |
| | | R6 | F-3 | R41 | I-3 | | | | |

Figure M3-2 CRT CATHODE PCB Assembly 19167



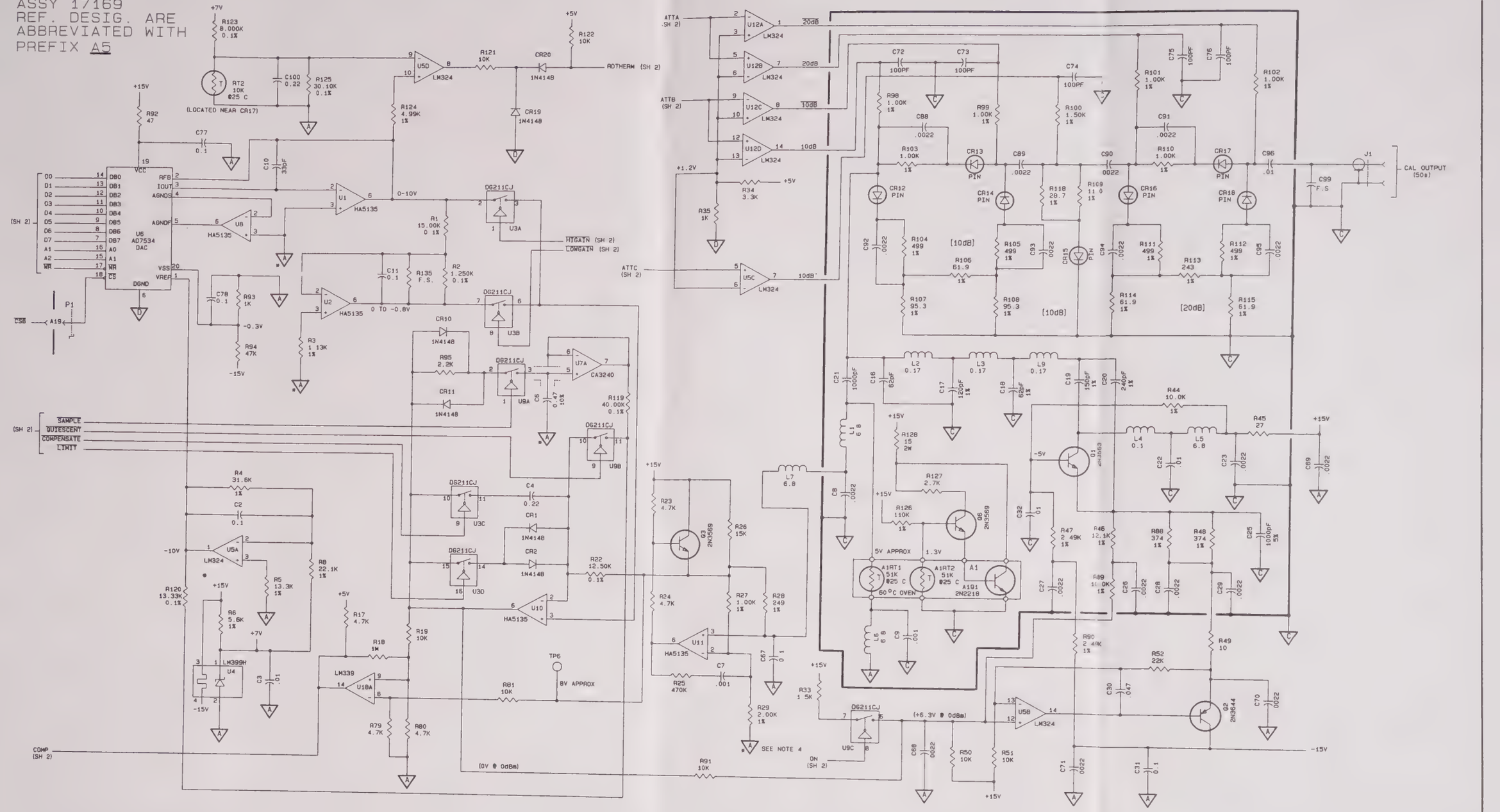

| | | | |
|---|---|---|---|
| DRAWN V. Vu | DATE 11-29-88 | WAVETEK MICROWAVE, INC. SUNNYVALE CALIFORNIA | |
| ENGINEER D. WATSON | 12-6-89 | ANALOG INTERCONNECT | |
| ENG G. Torneust | 12-8-89 | DRAWING NO. 17232 | REV 5 |
| MFG ENG H. Kuhn | 12-7-89 | SHEET 2 OF 2 | |




| CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A1 | F-3 | C47 | E-3 | C94 | G-5 | Q1 | H-3 | R37 | | R84 | C-6 | R131 | C-6 | U20 | H-7 |
| C1 | | C48 | E-3 | C95 | H-4 | Q2 | G-1 | R38 | | R85 | D-6 | R132 | E-6 | | |
| C2 | E-2 | C49 | F-6 | C96 | I-5 | Q3 | D-4 | R39 | | R86 | D-6 | R133 | C-5 | | |
| C3 | C-2 | C50 | F-6 | C97 | E-4 | Q4 | D-5 | R40 | | R87 | D-6 | R134 | B-5 | | |
| C4 | D-2 | C51 | F-6 | C98 | E-4 | Q5 | D-6 | R41 | | R88 | H-2 | R135 | C-2 | | |
| C5 | | C52 | F-6 | C99 | I-5 | Q6 | F-2 | R42 | | R89 | G-2 | | | | |
| C6 | E-3 | C53 | E-6 | C100 | H-4 | | | R43 | | R90 | G-1 | | | | |
| C7 | D-4 | C54 | E-6 | C101 | D-6 | | | R44 | I-3 | R91 | E-3 | | | | |
| C8 | F-3 | C55 | D-2 | C102 | H-6 | P1 | G-7 | R45 | H-2 | R92 | C-4 | | | | |
| C9 | | C56 | C-2 | | | | | R46 | H-2 | R93 | C-3 | RP1 | | | |
| C10 | B-3 | C57 | D-3 | | | | | R47 | I-3 | R94 | C-3 | RP2 | | | |
| C11 | C-2 | C58 | D-3 | | | | | R48 | H-2 | R95 | D-2 | RP3 | | | |
| C12 | | C59 | | CR1 | D-2 | R1 | C-2 | R49 | F-1 | R96 | B-5 | RP4 | | | |
| C13 | | C60 | F-5 | CR2 | D-2 | R2 | C-2 | R50 | F-1 | R97 | B-5 | RP5 | F-6 | | |
| C14 | | C61 | E-5 | CR3 | | R3 | C-3 | R51 | F-2 | R98 | F-4 | RP6 | G-6 | | |
| C15 | | C62 | G-5 | CR4 | | R4 | D-2 | R52 | F-1 | R99 | G-4 | | | | |
| C16 | G-3 | C63 | H-6 | CR5 | | R5 | E-2 | R53 | H-6 | R100 | H-4 | | | | |
| C17 | G-3 | C64 | H-6 | CR6 | | R6 | C-2 | R54 | H-6 | R101 | H-4 | RT1 | | | |
| C18 | G-3 | C65 | | CR7 | | R7 | | R55 | G-6 | R102 | I-4 | RT2 | H-4 | | |
| C19 | H-3 | C66 | D-5 | CR8 | H-6 | R8 | C-2 | R56 | G-6 | R103 | F-4 | RT3 | D-5 | | |
| C20 | H-3 | C67 | C-4 | CR9 | | R9 | | R57 | H-6 | R104 | F-4 | | | | |
| C21 | F-3 | C68 | E-2 | CR10 | D-2 | R10 | | R58 | H-6 | R105 | G-4 | TP1 | B-4 | | |
| C22 | H-3 | C69 | H-1 | CR11 | D-2 | R11 | | R59 | G-6 | R106 | F-4 | TP2 | C-2 | | |
| C23 | I-2 | C70 | G-1 | CR12 | F-4 | R12 | | R60 | G-6 | R107 | F-5 | TP3 | B-3 | | |
| C24 | | C71 | G-1 | CR13 | G-4 | R13 | | R61 | D-5 | R108 | G-5 | TP4 | D-5 | | |
| C25 | H-3 | C72 | F-4 | CR14 | G-4 | R14 | | R62 | | R109 | G-4 | TP5 | D-6 | | |
| C26 | H-2 | C73 | F-4 | CR15 | G-5 | R15 | | R63 | C-2 | R110 | H-4 | | | | |
| C27 | I-3 | C74 | F-4 | CR16 | H-4 | R16 | | R64 | D-3 | R111 | G-5 | | | | |
| C28 | H-2 | C75 | F-4 | CR17 | H-4 | R17 | H-6 | R65 | E-2 | R112 | H-4 | U1 | C-2 | | |
| C29 | H-2 | C76 | F-4 | CR18 | H-4 | R18 | H-6 | R66 | D-4 | R113 | H-5 | U2 | C-2 | | |
| C30 | E-2 | C77 | C-3 | CR19 | C-4 | R19 | H-6 | R67 | E-3 | R114 | H-4 | U3 | D-2 | | |
| C31 | G-1 | C78 | C-3 | CR20 | C-5 | R20 | | R68 | | R115 | H-4 | U4 | C-3 | | |
| C32 | H-3 | C79 | B-5 | CR21 | C-6 | R21 | | R69 | | R116 | E-4 | U5 | E-2 | | |
| C33 | | C80 | D-5 | | | R22 | D-4 | R70 | C-3 | R117 | E-4 | U6 | C-3 | | |
| C34 | | C81 | | | | R23 | D-4 | R71 | D-3 | R118 | G-5 | U7 | D-3 | | |
| C35 | C-6 | C82 | G-6 | J1 | I-5 | R24 | D-4 | R72 | E-2 | R119 | D-3 | U8 | D-3 | | |
| C36 | E-5 | C83 | G-6 | | | R25 | D-4 | R73 | C-4 | R120 | D-3 | U9 | E-3 | | |
| C37 | | C84 | G-6 | | | R26 | D-4 | R74 | E-2 | R121 | C-5 | U10 | C-4 | | |
| C38 | | C85 | | L1 | F-3 | R27 | D-4 | R75 | D-2 | R122 | D-5 | U11 | C-4 | | |
| C39 | B-2 | C86 | G-5 | L2 | G-2 | R28 | D-4 | R76 | C-2 | R123 | E-3 | U12 | E-4 | | |
| C40 | C-2 | C87 | G-6 | L3 | G-3 | R29 | D-4 | R77 | D-3 | R124 | D-2 | U13 | C-5 | | |
| C41 | D-3 | C88 | F-4 | L4 | H-3 | R30 | | R78 | D-3 | R125 | F-4 | U14 | D-5 | | |
| C42 | D-3 | C89 | G-4 | L5 | H-3 | R31 | | R79 | I-6 | R126 | G-2 | U15 | E-5 | | |
| C43 | E-2 | C90 | H-4 | L6 | E-3 | R32 | | R80 | H-6 | R127 | F-2 | U16 | F-5 | | |
| C44 | E-2 | C91 | H-4 | L7 | D-4 | R33 | E-3 | R81 | I-6 | R128 | E-2 | U17 | G-5 | | |
| C45 | C-4 | C92 | F-4 | L8 | | R34 | E-5 | R82 | | R129 | C-3 | U18 | H-5 | | |
| C46 | D-4 | C93 | G-4 | L9 | G-3 | R35 | E-5 | R83 | D-6 | R130 | D-5 | U19 | H-7 | | |

Figure M3-5 CALIBATOR PCB Assembly 17169

ASSY 17169
REF. DESIG. ARE ABBREVIATED WITH PREFIX A5




NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTOR VALUES ARE IN OHMS, 5%, 1/4W.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, 50V, 20%.
3. ALL INDUCTOR VALUES ARE IN MICROHENRYS.
4. ALL GNDS LABELED ▽ ARE TIED TO ▽ AT THIS POINT.
5. ALL REFERENCE DESIGNATORS MARKED WITH AN *F.S.* ARE FACTORY SELECTED
6. PIN DESIGNATES PIN DIODE.

| ITEM | REQD | PART NO | DESCRIPTION |
|---|---|---|---|
| | | | LIST OF MATERIAL |

| | | |
|---|---|---|
| FINISH OR TREATMENT | UNLESS OTHERWISE INDICATED DIMENSIONS ARE IN INCHES TOLERANCE .XX - .01 .XXX - .005 ANGLE - 1/2° | DRAWN MINH LE 2/10/89 |
| | | CHECKED D. WATSON 12-7-89 |
| | | ENG H. Kehm 12-7-89 |
| | | MFG ENG H Kehm 12-7-89 |
| | SCALE | |

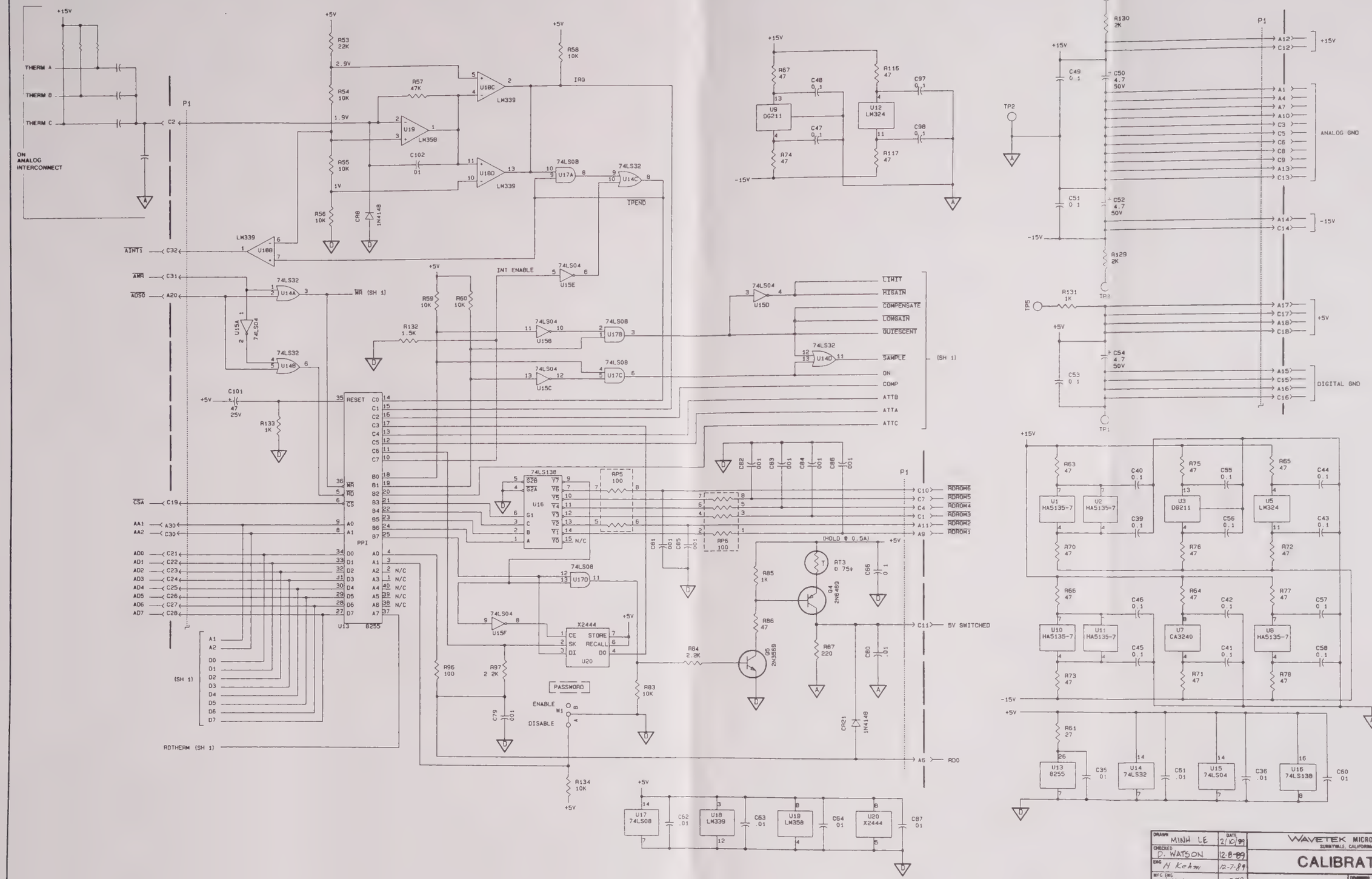
NEXT ASSY

WAVETEK MICROWAVE, INC.
SUNNYVALE, CALIFORNIA

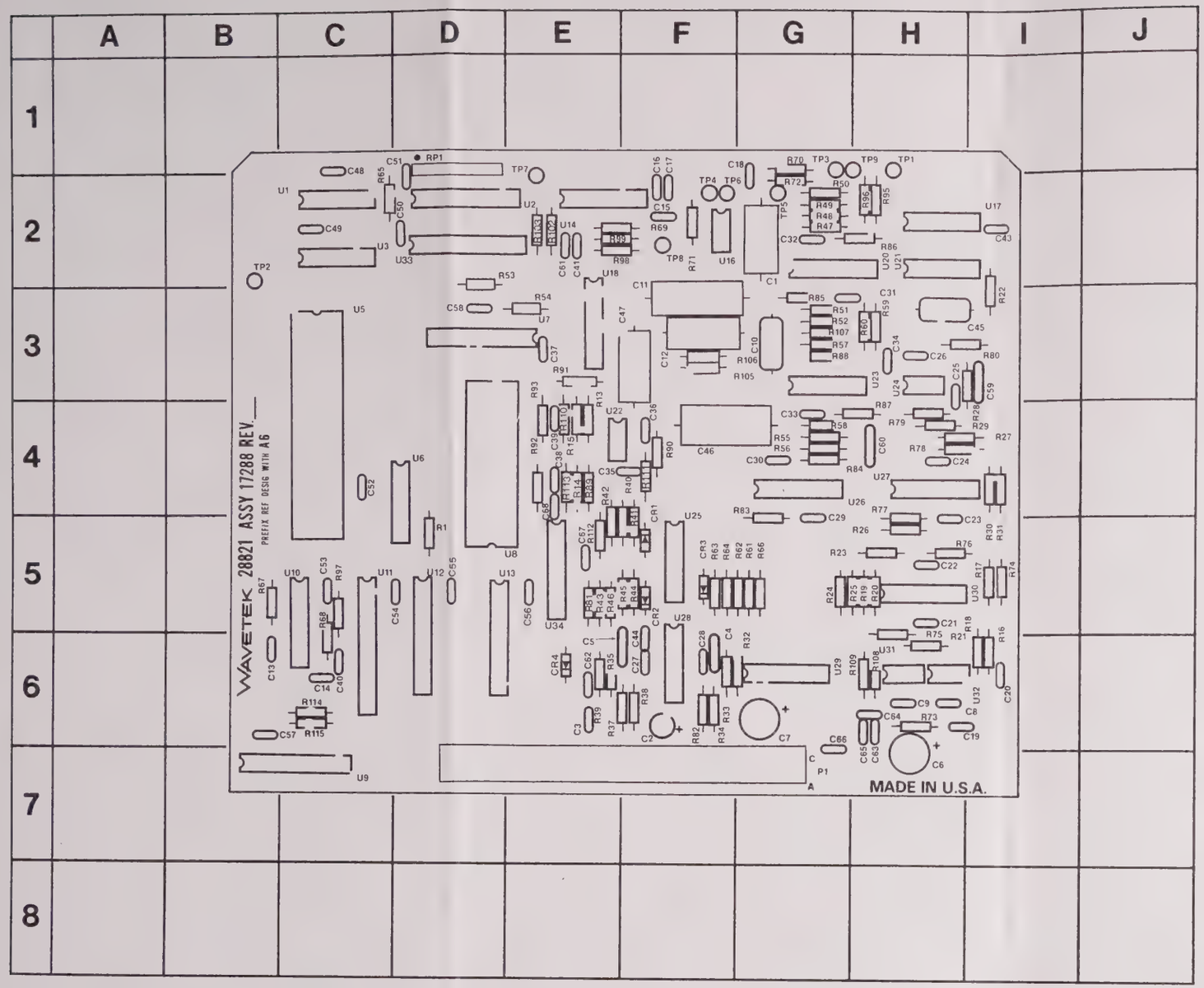
CALIBRATOR

DRAWING NO 17170 REV B

SHEET 1 OF 2



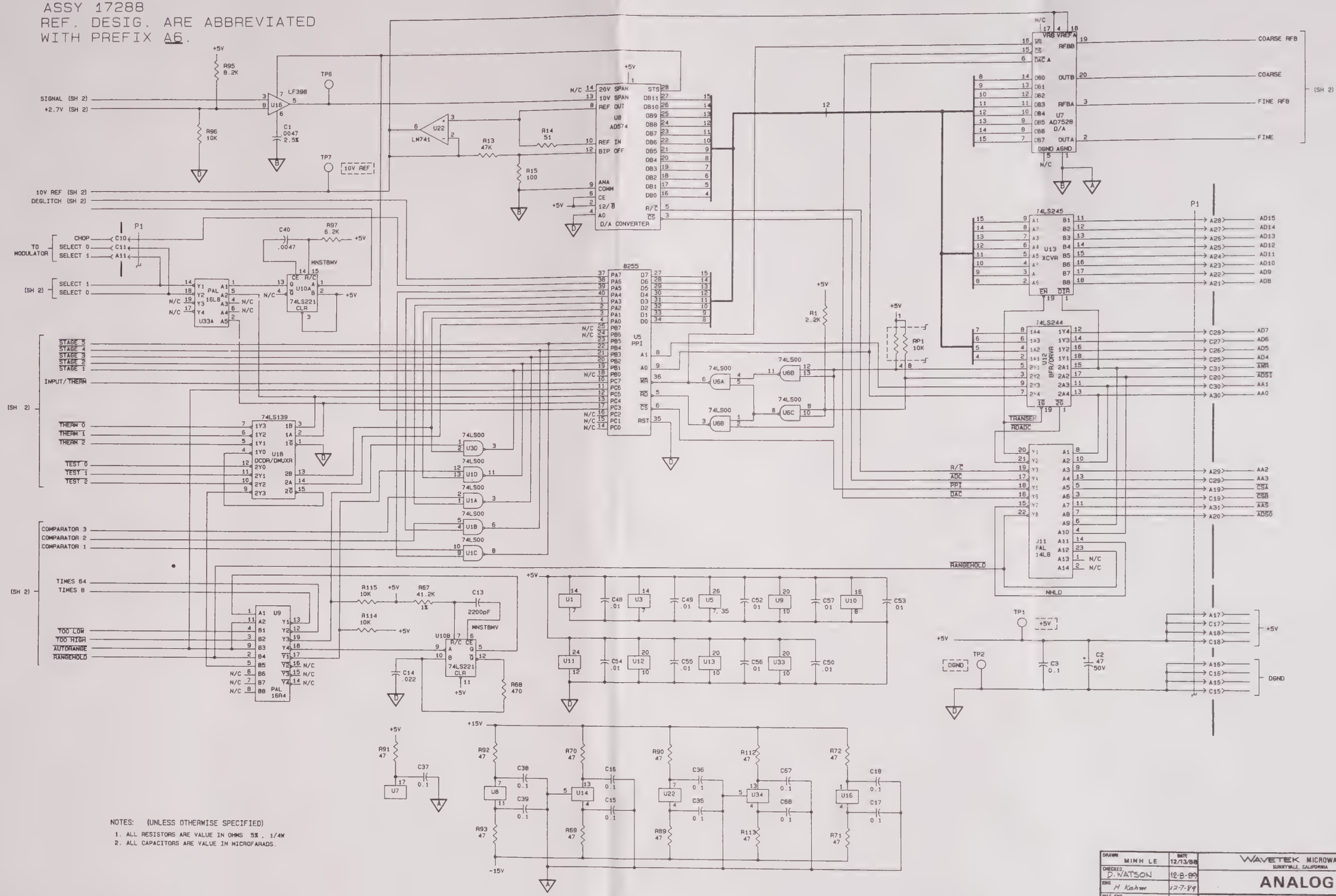

| | | |
|---|---|---|
| DRAWN MINH LE | DATE 2/10/89 | WAVETEK MICROWAVE, INC. SUNNYVALE, CALIFORNIA |
| CHECKED D. WATSON | 12-8-89 | CALIBRATOR |
| ENG H Kohm | 12-7-89 | DRAWING NO 17170 REV B |
| MFG ENG H. Kohm | 12-7-89 | SHEET 2 OF 2 |




| CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC |
|---|---|---|---|---|---|---|---|---|---|---|---|
| C1 | G-2 | C48 | C-2 | R17 | I-5 | R64 | F-5 | R111 | F-4 | U27 | H-4 |
| C2 | F-6 | C49 | C-2 | R18 | I-6 | R65 | D-2 | R112 | E-5 | U28 | F-6 |
| C3 | E-6 | C50 | D-2 | R19 | H-5 | R66 | G-5 | R113 | E-4 | U29 | G-6 |
| C4 | F-6 | C51 | D-2 | R20 | H-5 | R67 | C-5 | R114 | C-6 | U30 | H-5 |
| C5 | F-6 | C52 | C-4 | R21 | H-6 | R68 | C-6 | R115 | C-6 | U31 | H-6 |
| C6 | H-7 | C53 | C-5 | R22 | I-3 | R69 | F-2 | | | U32 | H-6 |
| C7 | G-6 | C54 | D-5 | R23 | H-5 | R70 | G-2 | | | U33 | D-2 |
| C8 | H-6 | C55 | D-5 | R24 | G-5 | R71 | F-2 | RP1 | D-2 | U34 | E-5 |
| C9 | H-6 | C56 | E-5 | R25 | H-5 | R72 | G-2 | | | | |
| C10 | G-3 | C57 | B-6 | R26 | H-5 | R73 | H-6 | | | | |
| C11 | F-3 | C58 | D-3 | R27 | I-4 | R74 | I-5 | TP1 | H-2 | | |
| C12 | F-3 | C59 | I-3 | R28 | I-3 | R75 | H-6 | TP2 | B-2 | | |
| C13 | C-6 | C60 | H-4 | R29 | H-4 | R76 | H-5 | TP3 | G-2 | | |
| C14 | C-6 | C61 | E-2 | R30 | I-4 | R77 | H-5 | TP4 | F-2 | | |
| C15 | F-2 | C62 | E-6 | R31 | I-4 | R78 | I-4 | TP5 | G-2 | | |
| C16 | F-2 | C63 | H-6 | R32 | G-6 | R79 | H-4 | TP6 | F-2 | | |
| C17 | F-2 | C64 | H-6 | R33 | F-6 | R80 | I-3 | TP7 | E-2 | | |
| C18 | G-2 | C65 | H-6 | R34 | F-6 | R81 | E-5 | TP8 | F-2 | | |
| C19 | I-6 | C66 | G-7 | R35 | E-6 | R82 | F-6 | TP9 | H-2 | | |
| C20 | I-6 | C67 | E-5 | R36 | | R83 | G-5 | | | | |
| C21 | H-5 | C68 | E-4 | R37 | F-6 | R84 | G-4 | | | | |
| C22 | H-5 | | | R38 | F-6 | R85 | G-3 | U1 | C-2 | | |
| C23 | H-5 | | | R39 | E-6 | R86 | H-2 | U2 | D-2 | | |
| C24 | H-4 | CR1 | F-5 | R40 | F-5 | R87 | H-4 | U3 | C-2 | | |
| C25 | H-3 | CR2 | F-5 | R41 | F-5 | R88 | G-3 | U4 | | | |
| C26 | H-3 | CR3 | F-5 | R42 | E-5 | R89 | E-4 | U5 | C-3 | | |
| C27 | F-6 | CR4 | E-6 | R43 | E-5 | R90 | F-4 | U6 | D-4 | | |
| C28 | F-6 | | | R44 | F-5 | R91 | E-3 | U7 | E-3 | | |
| C29 | G-5 | P1 | G-7 | R45 | F-5 | R92 | E-4 | U8 | D-5 | | |
| C30 | G-4 | | | R46 | E-5 | R93 | E-4 | U9 | C-7 | | |
| C31 | H-3 | | | R47 | G-2 | R94 | | U10 | C-5 | | |
| C32 | G-2 | R1 | D-5 | R48 | G-2 | R95 | H-2 | U11 | C-5 | | |
| C33 | G-4 | R2 | | R49 | G-2 | R96 | H-2 | U12 | D-5 | | |
| C34 | H-3 | R3 | | R50 | G-2 | R97 | C-5 | U13 | E-5 | | |
| C35 | F-4 | R4 | | R51 | G-3 | R98 | F-2 | U14 | E-2 | | |
| C36 | F-4 | R5 | | R52 | G-3 | R99 | F-2 | U15 | | | |
| C37 | E-3 | R6 | | R53 | D-3 | R100 | | U16 | F-2 | | |
| C38 | E-4 | R7 | | R54 | E-3 | R101 | | U17 | H-2 | | |
| C39 | E-4 | R8 | | R55 | G-4 | R102 | E-2 | U18 | E-3 | | |
| C40 | C-6 | R9 | | R56 | G-4 | R103 | E-2 | U19 | | | |
| C41 | E-2 | R10 | | R57 | G-3 | R104 | | U20 | G-2 | | |
| C42 | | R11 | | R58 | G-4 | R105 | F-3 | U21 | H-2 | | |
| C43 | I-2 | R12 | | R59 | H-3 | R106 | F-3 | U22 | E-4 | | |
| C44 | F-6 | R13 | E-4 | R60 | H-3 | R107 | G-3 | U23 | H-3 | | |
| C45 | H-3 | R14 | E-4 | R61 | G-5 | R108 | H-6 | U24 | H-3 | | |
| C46 | F-4 | R15 | E-4 | R62 | G-5 | R109 | H-6 | U25 | F-5 | | |
| C47 | F-3 | R16 | I-6 | R63 | F-5 | R110 | E-4 | U26 | G-4 | | |

Figure M3-6 ANALOG PCB Assembly 17288

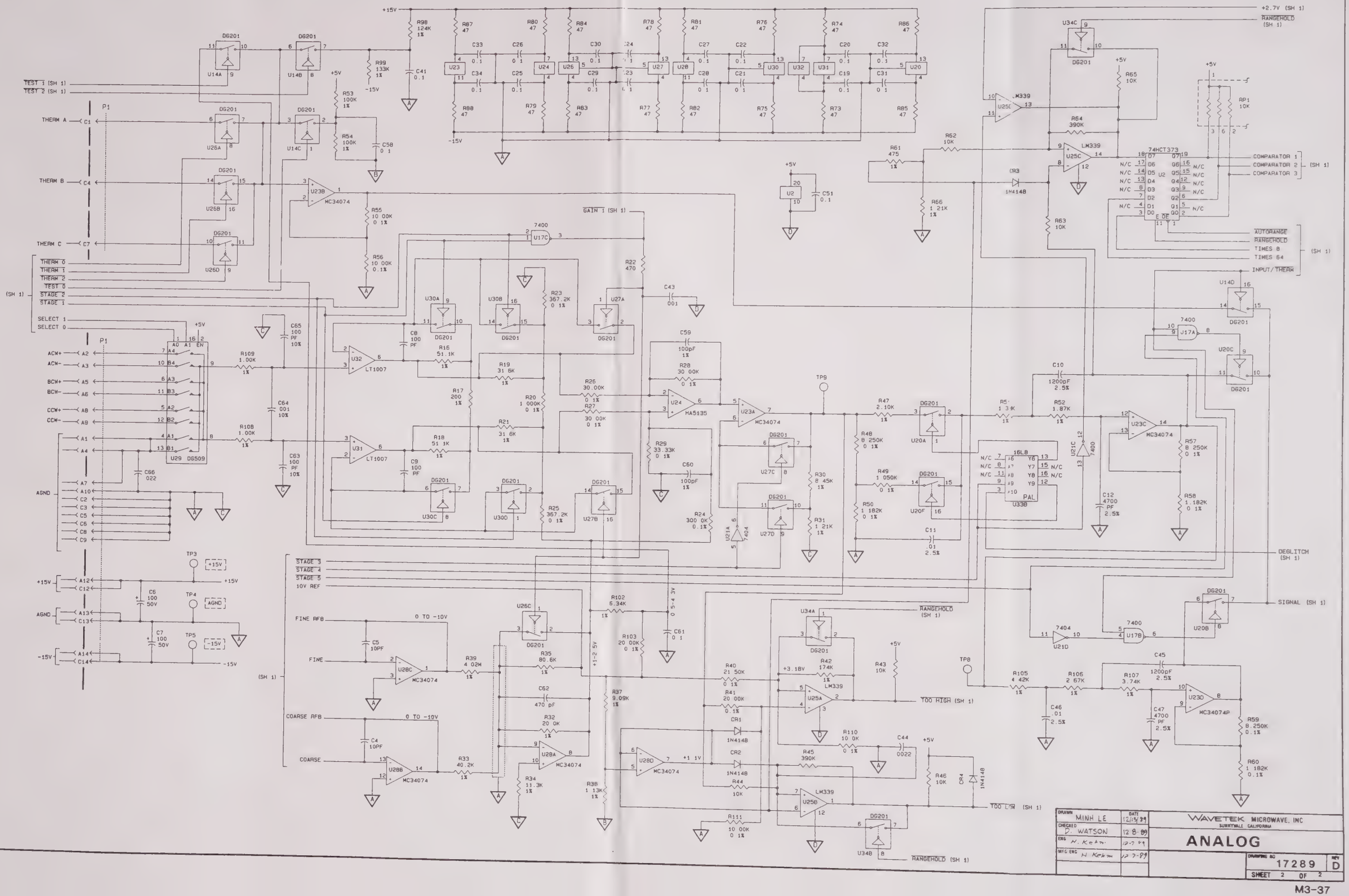
ASSY 17288
REF. DESIG. ARE ABBREVIATED
WITH PREFIX A6.



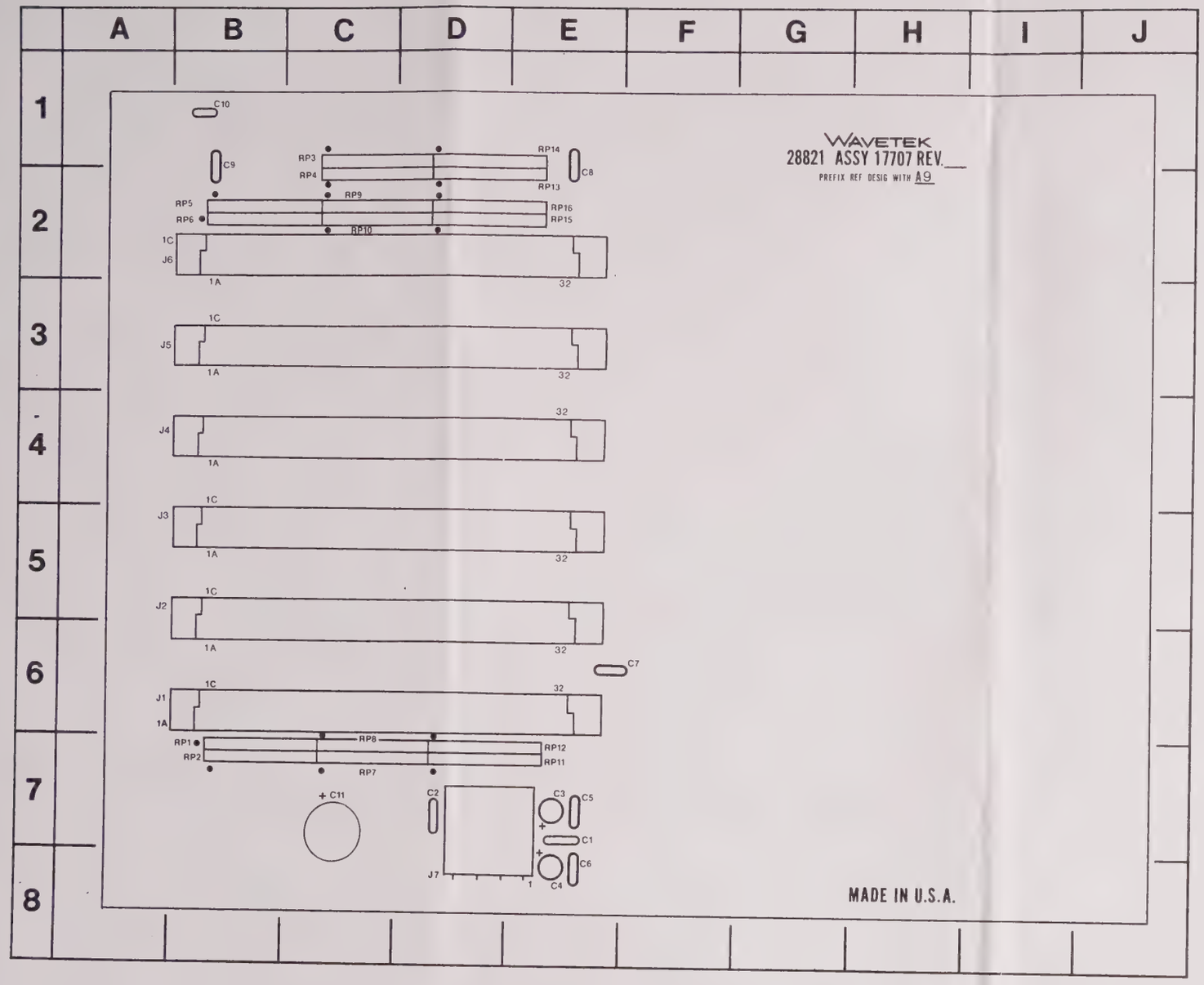

NOTES: (UNLESS OTHERWISE SPECIFIED)

1. ALL RESISTORS ARE VALUE IN OHMS 5%, 1/4W
2. ALL CAPACITORS ARE VALUE IN MICROFARADS.

| | | |
|---|---|---|
| DRAWN MINH LE | DATE 12/13/88 | WAVETEK MICROWAVE, INC. SUNNYVALE, CALIFORNIA |
| CHECKED D. WATSON | 12-8-89 | ANALOG |
| ENG H. Kahm | 12-7-89 | DRAWING NO 17289 REV D |
| MFG ENG H. Kahm | 12-7-89 | SHEET 1 OF 2 |

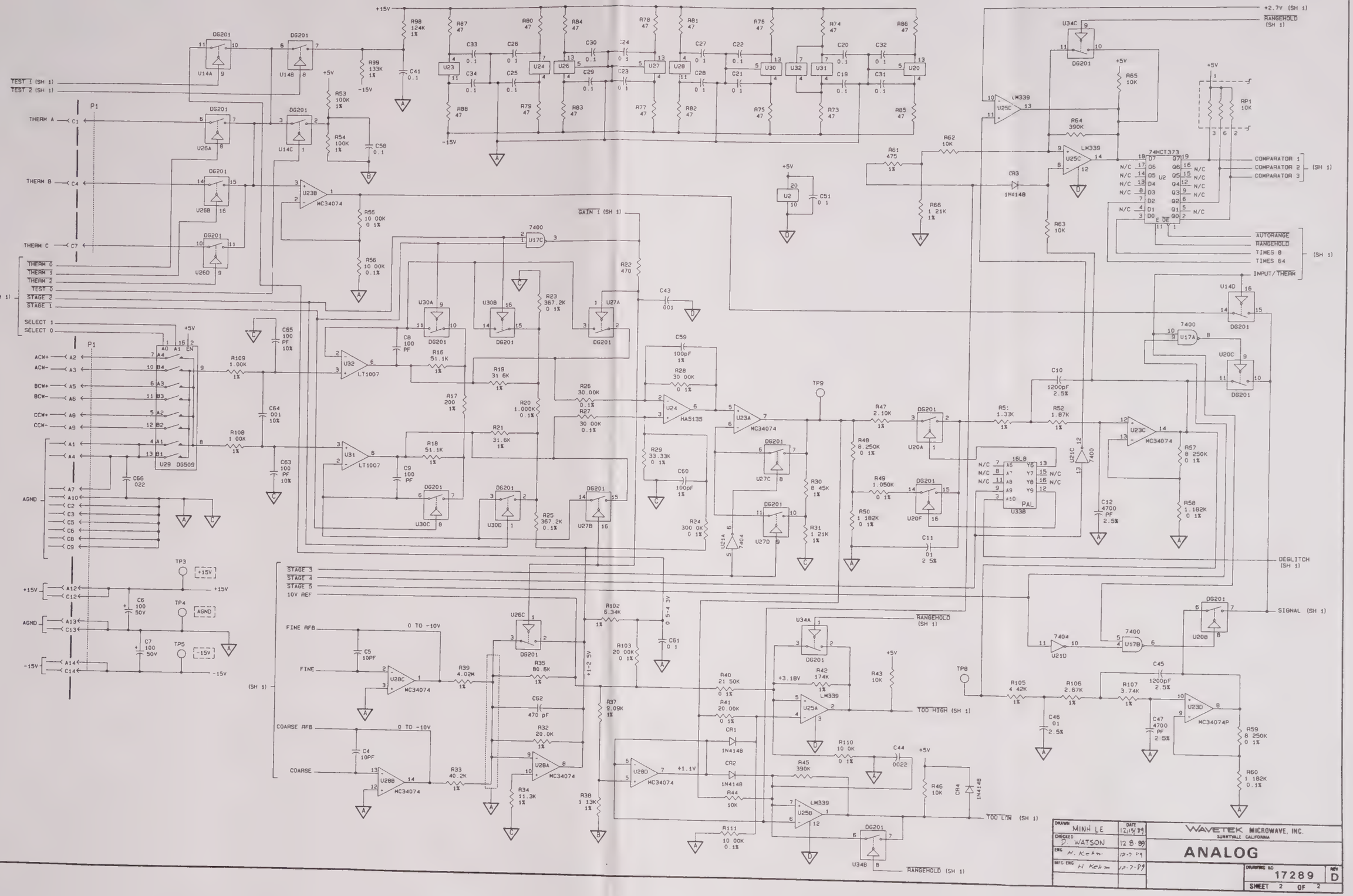



| | | | |
|---|---|---|---|
| DRAWN MINH LE | DATE 12/15/89 | WAVETEK MICROWAVE, INC SUNNYVALE CALIFORNIA | |
| CHECKED D. WATSON | 12-8-89 | ANALOG | |
| ENG N. Kelm | 12-7-89 | DRAWING NO 17289 | REV D |
| MFG ENG N. Kelm | 12-7-89 | SHEET 2 OF 2 | |



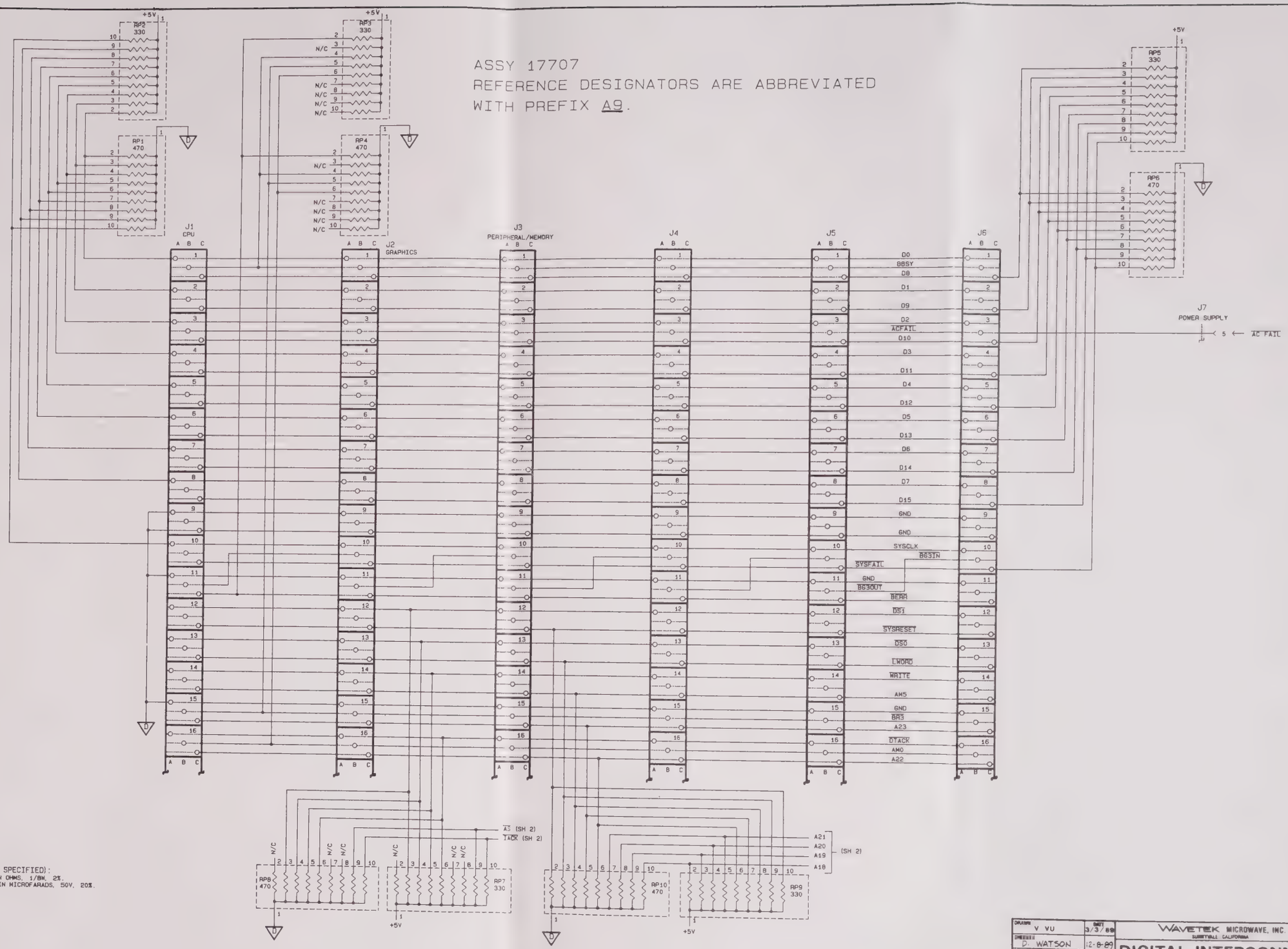

| CKT REF | GRID LOC |
|---|---|
| C1 | E-7 |
| C2 | D-7 |
| C3 | E-7 |
| C4 | E-8 |
| C5 | E-7 |
| C6 | E-8 |
| C7 | E-6 |
| C8 | E-2 |
| C9 | B-2 |
| C10 | B-1 |
| C11 | C-7 |
| | |
| J1 | B-6 |
| J2 | B-5 |
| J3 | B-5 |
| J4 | B-4 |
| J5 | B-3 |
| J6 | B-2 |
| J7 | D-8 |
| | |
| RP1 | B-7 |
| RP2 | B-7 |
| RP3 | C-2 |
| RP4 | C-2 |
| RP5 | B-2 |
| RP6 | B-2 |
| RP7 | C-7 |
| RP8 | C-7 |
| RP9 | C-2 |
| RP10 | C-2 |
| RP11 | E-7 |
| RP12 | E-7 |
| RP13 | E-2 |
| RP14 | E-2 |

Figure M3-7 DIGITAL INTERCONECT PCB Assembly 17707




| | | | |
|---|---|---|---|
| DRAWN MINH LE | DATE 12/15/89 | WAVETEK MICROWAVE, INC. SUNNYVALE CALIFORNIA | |
| CHECKED D. WATSON | 12.8.89 | ANALOG | |
| ENG N. Kohm | 12-7-89 | DRAWING NO 17289 | REV D |
| MFG ENG N Kohm | 12-7-89 | SHEET 2 OF 2 | |

ASSY 17707
REFERENCE DESIGNATORS ARE ABBREVIATED
WITH PREFIX A9.




NOTES (UNLESS OTHERWISE SPECIFIED):
1. RESISTOR VALUES ARE IN OHMS, 1/8W, 2%.
2. CAPACITOR VALUES ARE IN MICROFARADS, 50V, 20%.

| | | |
|---|---|---|
| DRAWN V VU | DATE 3/3/89 | WAVETEK MICROWAVE, INC. SUNNYVALE CALIFORNIA |
| ENGINEER D. WATSON | 12-8-89 | DIGITAL INTERCONNECT |
| ENG G. Torquist | 12 8-89 | |
| MFG ENG H Kahm | 12-7-89 | DRAWING NO 17708 REV A |
| | | SHEET 1 OF 2 |

J1 CPU

J2 GRAPHICS

J3 PERIPHERAL/MEMORY

J4

J5

J6

A21 (SH 1)

$\overline{A5}$ (SH 1)

A20 (SH 1)

A19 (SH 1)

$\overline{IACK}$ (SH 1)

A18 (SH 1)

GND
AM1
A21
$\overline{A5}$
AM2
A20
GND
AM3
A19
$\overline{IACK}$
GND
A18
IACKIN
A17
IACKOUT
A16
AM4
GND
A15
A7
$\overline{IRQ7}$
A14
A6
$\overline{IRQ6}$
A13
A5
$\overline{IRQ5}$
A12
A4
$\overline{IRQ4}$
A11
A3
$\overline{IRQ3}$
A10
A2
$\overline{IRQ2}$
A9
A1
$\overline{IRQ1}$
A8
-12V
+5V STDBY
+12V
+5V
+5V
+5V

+5V

RP11 330

RP12 470

RP13 330

RP14 470

RP16 330

RP15 470

J7

D COM

+5V STDBY

-12V

+12V

FROM POWER SUPPLY

+5V

C1 0.47

C3 10

C5 0.1

C4 10

C6 0.1

C11 2200 10V

C2 0.47

C7 0.01

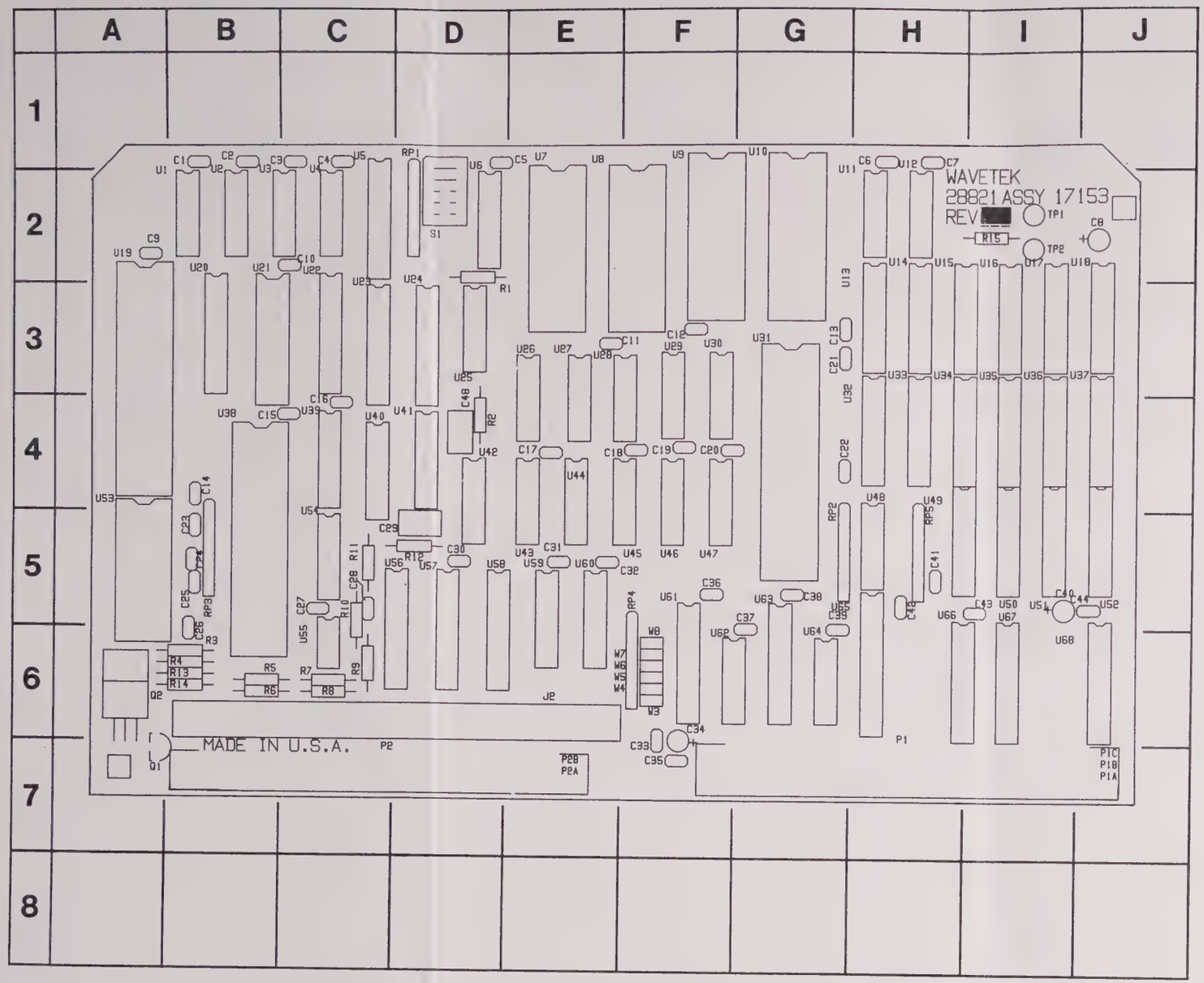
C8 0.01

C9 0.01

C10 0.01

| | | | |
|---|---|---|---|
| DRAWN V. Vu | DATE 3-3-89 | WAVETEK MICROWAVE, INC. | |
| CHECKED D. WATSON | 12-8-89 | DIGITAL INTERCONNECT | |
| ENG G. Tornquist | 12-8-89 | | |
| MFG ENG H Kahm | 12-7-89 | DRAWING NO 17708 | REV A |
| | | SHEET 2 OF 2 | |

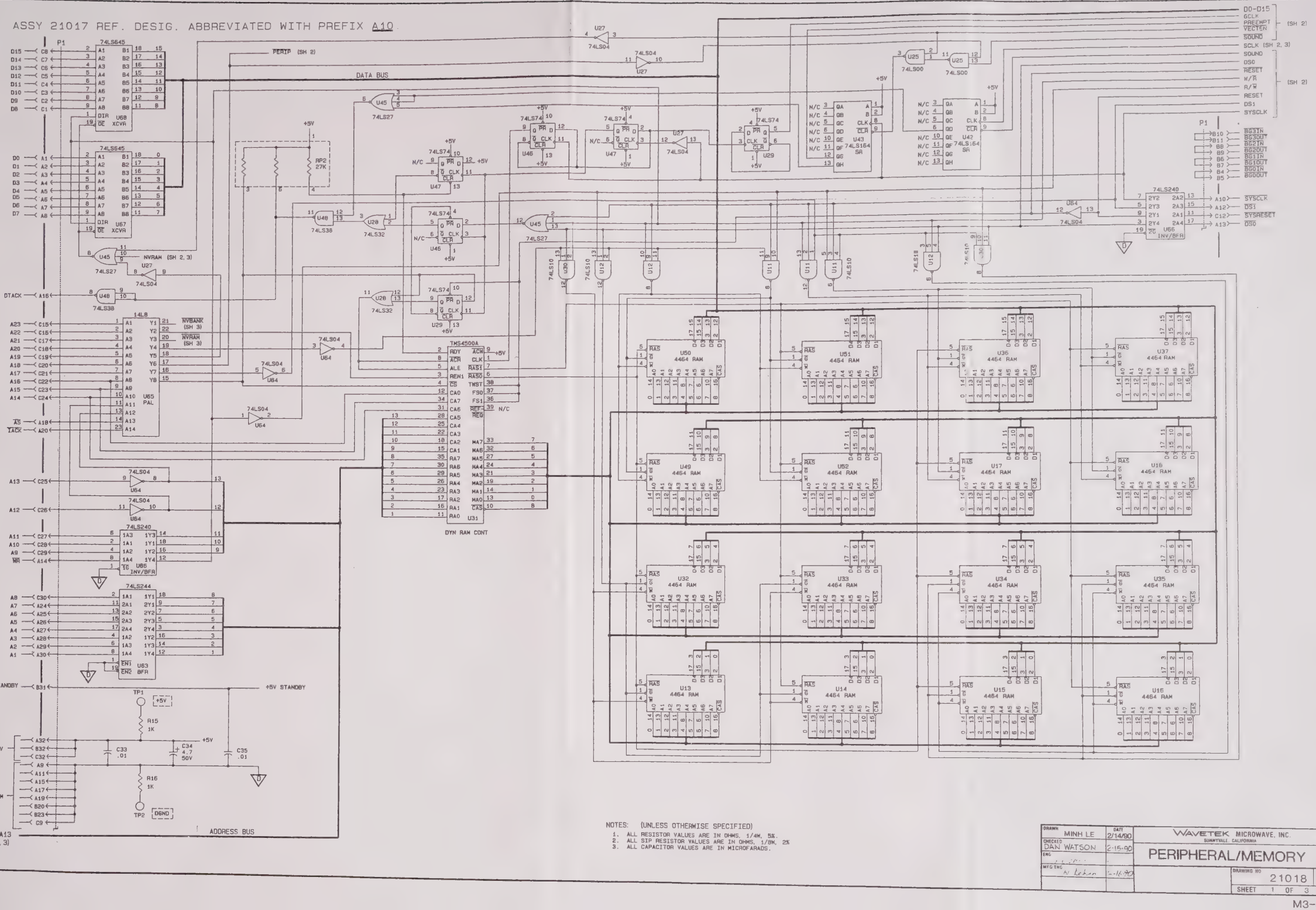
M3-41




| CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC |
|---|---|---|---|---|---|---|---|
| C1 | B-1 | C48 | D-4 | U1 | B-2 | U48 | H-5 |
| C2 | B-1 | | | U2 | B-2 | U49 | H-5 |
| C3 | C-1 | | | U3 | C-2 | U50 | I-5 |
| C4 | C-1 | | | U4 | C-2 | U51 | I-5 |
| C5 | D-1 | J1 | | U5 | C-2 | U52 | J-5 |
| C6 | H-1 | J2 | E-6 | U6 | D-2 | U53 | A-5 |
| C7 | H-1 | | | U7 | E-2 | U54 | C-5 |
| C8 | J-2 | | | U8 | F-2 | U55 | C-6 |
| C9 | A-2 | P1 | H-7 | U9 | F-2 | U56 | D-5 |
| C10 | C-2 | P2 | C-7 | U10 | G-2 | U57 | D-5 |
| C11 | E-3 | | | U11 | H-2 | U58 | D-5 |
| C12 | F-3 | | | U12 | H-2 | U59 | E-5 |
| C13 | G-3 | Q1 | A-7 | U13 | H-3 | U60 | E-5 |
| C14 | B-4 | Q2 | A-6 | U14 | H-3 | U61 | F-6 |
| C15 | C-4 | | | U15 | H-3 | U62 | F-6 |
| C16 | C-4 | | | U16 | I-3 | U63 | G-6 |
| C17 | E-4 | R1 | D-3 | U17 | I-3 | U64 | G-6 |
| C18 | F-4 | R2 | D-4 | U18 | J-3 | U65 | H-6 |
| C19 | F-4 | R3 | B-6 | U19 | A-3 | U66 | I-6 |
| C20 | F-4 | R4 | B-6 | U20 | B-3 | U67 | I-6 |
| C21 | G-3 | R5 | B-6 | U21 | B-3 | U68 | J-6 |
| C22 | G-4 | R6 | B-6 | U22 | C-3 | | |
| C23 | B-5 | R7 | C-6 | U23 | C-3 | | |
| C24 | B-5 | R8 | C-6 | U24 | D-3 | W1 | F-6 |
| C25 | B-5 | R9 | C-6 | U25 | D-3 | W2 | F-6 |
| C26 | B-6 | R10 | C-6 | U26 | E-3 | W3 | F-6 |
| C27 | C-5 | R11 | C-6 | U27 | E-3 | W4 | F-6 |
| C28 | C-5 | R12 | D-5 | U28 | F-3 | W5 | F-6 |
| C29 | D-5 | R13 | B-6 | U29 | F-3 | W6 | F-6 |
| C30 | D-5 | R14 | B-6 | U30 | F-3 | W7 | F-6 |
| C31 | E-5 | R15 | I-2 | U31 | G-3 | W8 | F-6 |
| C32 | E-5 | | | U32 | H-4 | | |
| C33 | F-7 | | | U33 | H-4 | | |
| C34 | F-7 | RP1 | | U34 | I-4 | | |
| C35 | F-7 | RP2 | G-5 | U35 | I-4 | | |
| C36 | F-5 | RP3 | | U36 | I-4 | | |
| C37 | G-6 | RP4 | F-6 | U37 | J-4 | | |
| C38 | G-5 | RP5 | H-5 | U38 | B-4 | | |
| C39 | G-6 | | | U39 | C-4 | | |
| C40 | I-5 | | | U40 | C-4 | | |
| C41 | H-5 | S1 | D-2 | U41 | D-4 | | |
| C42 | H-5 | | | U42 | D-4 | | |
| C43 | I-5 | | | U43 | E-4 | | |
| C44 | J-5 | TP1 | I-2 | U44 | E-4 | | |
| C45 | | TP2 | I-2 | U45 | F-4 | | |
| C46 | | | | U46 | F-4 | | |
| C47 | | | | U47 | F-4 | | |

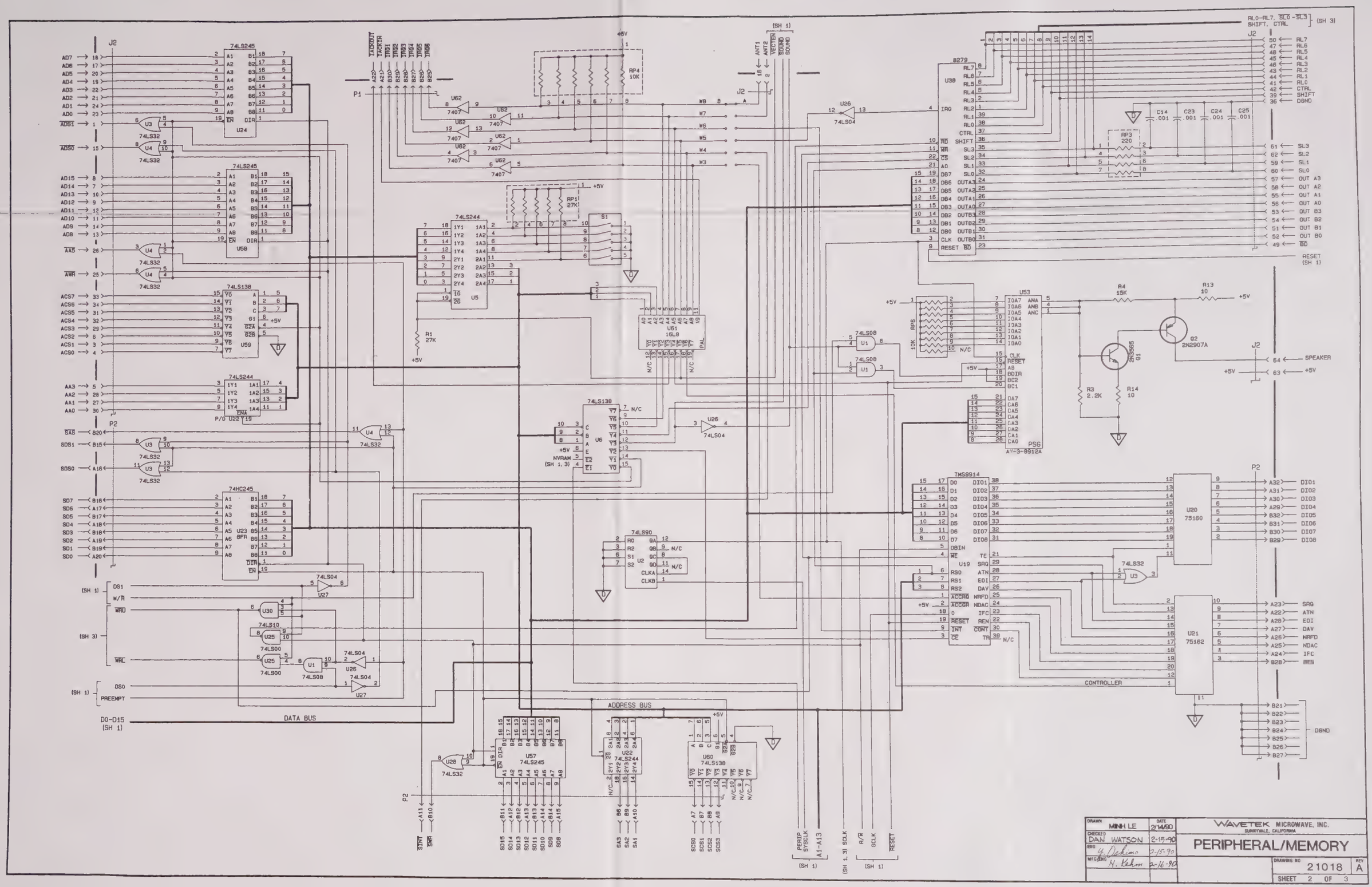
Figure M3-8 PERIPHERAL/MEMORY PCB Assembly 17153

ASSY 21017 REF. DESIG. ABBREVIATED WITH PREFIX A10




NOTES: (UNLESS OTHERWISE SPECIFIED)
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
2. ALL SIP RESISTOR VALUES ARE IN OHMS, 1/8W, 2%
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.

| | | | |
|---|---|---|---|
| DRAWN MINH LE | DATE 2/14/90 | WAVETEK MICROWAVE, INC. SUNNYVALE, CALIFORNIA | |
| CHECKED DAN WATSON | 2-15-90 | PERIPHERAL/MEMORY | |
| ENG | | DRAWING NO 21018 | REV A |
| MFG ENG N Tobin | 2-16-90 | SHEET 1 OF 3 | |


J2
P1
P2
74LS245
74LS32
74LS244
74LS138
74HC245
74LS04
74LS08
74LS00
74LS10
74LS90
74LS244
16L8
PAL
RP1 27K
RP4 10K
R1 27K
S1
U1
U2
U3
U4
U5
U6
U23 BFR
U24
U25
U26
U27
U28
U30
U51
U57 74LS245
U58
U59
U60 74LS138
U61 16L8
U62 7407
NVRAM (SH 1, 3)
8279
U38
IRQ
SHIFT
WR
CS
A0
CLK
RESET
RL7
RL6
RL5
RL4
RL3
RL2
RL1
RL0
CTRL
SHIFT
DBND
SL3
SL2
SL1
SL0
OUT A3
OUT A2
OUT A1
OUT A0
OUT B3
OUT B2
OUT B1
OUT B0
RP3 220
C14 .001
C23 .001
C24 .001
C25 .001
RP5 10K
U53
PSG
AY-3-8912A
R4 15K
R13 10
R3 2.2K
R14 10
Q1 2N3565
Q2 2N2907A
SPEAKER
TMS9914
U19
U20 75160
U21 75162
CONTROLLER
DIO1
DIO2
DIO3
DIO4
DIO5
DIO6
DIO7
DIO8
SRQ
ATN
EOI
DAV
NRFD
NDAC
IFC
REN
DGND
ADDRESS BUS
DATA BUS
D0-D15 (SH 1)
(SH 1)
(SH 3)
DRAWN MINH LE
DATE 2/14/90
CHECKED DAN WATSON 2-15-90
ENG Y. Dashimo 2-15-90
MFG ENG N. Kahn 2-16-90
WAVETEK MICROWAVE, INC.
SUNNYVALE, CALIFORNIA
PERIPHERAL/MEMORY
DRAWING NO 21018
REV A
SHEET 2 OF 3

SHIFT, CTRL, RL0-RL7, SL0 - SL3 (SH 2)

SCLK (SH 1, 2)

COIL 0-

COIL 0+

COIL 90-

COIL 90+

A1-A13 (SH 1)

A15 (SH 1)

A14 (SH 1)

D0-D15 (SH 1)

M/R (SH 2)

WRL (SH 2)

WRU (SH 2)

AC FAIL

NVRAM (SH 1, 2)

NVRAM (SH 1)

NVBANK (SH 1)

+5V STANDBY

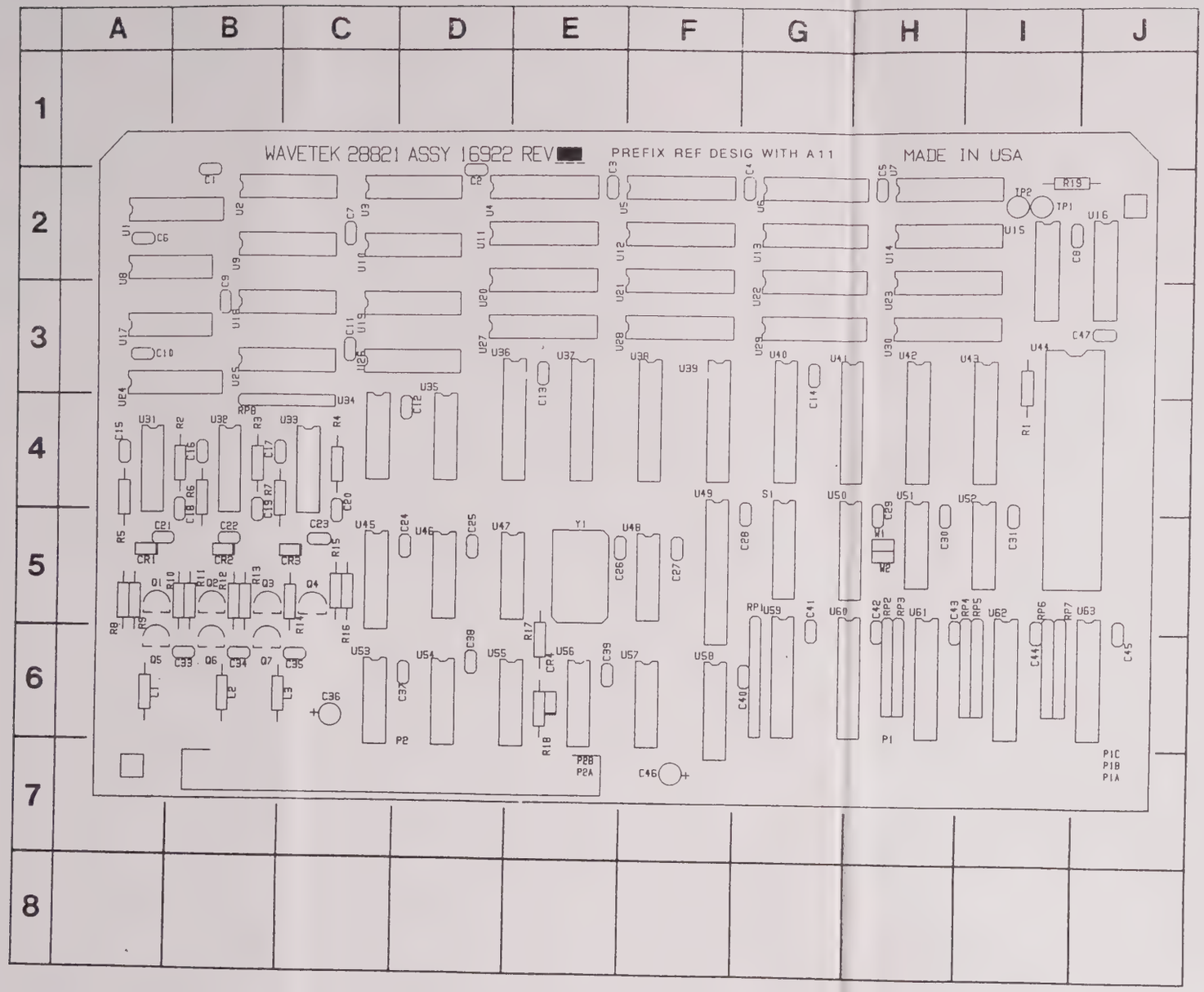
| | | | |
|---|---|---|---|
| DRAWN | MINH LE | DATE | 2/14/90 |
| CHECKED | DAN WATSON | | 2-15-90 |
| ENG | G. Ochima | | 2-15-90 |
| MFG ENG | | | |

WAVETEK MICROWAVE, INC
SUNNYVALE, CALIFORNIA

PERIPHERAL/MEMORY

DRAWING NO. 21018 REV A

SHEET 3 OF 3




| CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC |
|---|---|---|---|---|---|---|---|
| C1 | B-2 | CR1 | A-5 | RP3 | H-6 | U33 | C-4 |
| C2 | D-2 | CR2 | B-5 | RP4 | I-6 | U34 | C-4 |
| C3 | E-2 | CR3 | C-5 | RP5 | I-6 | U35 | D-4 |
| C4 | G-2 | CR4 | E-6 | RP6 | I-6 | U36 | E-3 |
| C5 | H-2 | | | RP7 | I-6 | U37 | E-3 |
| C6 | A-2 | | | RP8 | B-4 | U38 | F-3 |
| C7 | C-2 | L1 | A-6 | | | U39 | F-3 |
| C8 | I-2 | L2 | B-6 | | | U40 | G-3 |
| C9 | B-3 | L3 | C-6 | S1 | G-5 | U41 | H-3 |
| C10 | A-3 | | | | | U42 | H-3 |
| C11 | C-3 | | | | | U43 | I-3 |
| C12 | D-4 | P1 | H-7 | TP1 | I-2 | U44 | I-3 |
| C13 | E-3 | P2 | D-7 | TP2 | I-2 | U45 | C-5 |
| C14 | G-3 | | | | | U46 | D-5 |
| C15 | A-4 | | | | | U47 | E-5 |
| C16 | B-4 | Q1 | A-5 | U1 | A-2 | U48 | F-5 |
| C17 | C-4 | Q2 | B-5 | U2 | B-2 | U49 | F-5 |
| C18 | B-5 | Q3 | B-5 | U3 | C-2 | U50 | H-5 |
| C19 | B-5 | Q4 | C-5 | U4 | E-2 | U51 | H-5 |
| C20 | C-5 | Q5 | A-6 | U5 | F-2 | U52 | I-5 |
| C21 | A-5 | Q6 | B-6 | U6 | G-2 | U53 | C-6 |
| C22 | B-5 | Q7 | B-6 | U7 | H-2 | U54 | D-6 |
| C23 | C-5 | | | U8 | A-2 | U55 | E-6 |
| C24 | D-5 | | | U9 | B-2 | U56 | E-6 |
| C25 | D-5 | R1 | I-3 | U10 | C-2 | U57 | F-6 |
| C26 | E-5 | R2 | B-4 | U11 | E-2 | U58 | F-6 |
| C27 | F-5 | R3 | B-4 | U12 | F-2 | U59 | G-6 |
| C28 | G-5 | R4 | C-4 | U13 | G-2 | U60 | H-6 |
| C29 | H-5 | R5 | A-4 | U14 | H-2 | U61 | H-6 |
| C30 | H-5 | R6 | B-4 | U15 | I-2 | U62 | I-6 |
| C31 | I-5 | R7 | C-4 | U16 | J-2 | U63 | J-6 |
| C32 | | R8 | A-5 | U17 | A-3 | | |
| C33 | B-6 | R9 | A-5 | U18 | B-3 | | |
| C34 | B-6 | R10 | B-5 | U19 | C-3 | Y1 | E-5 |
| C35 | C-6 | R11 | B-5 | U20 | E-3 | | |
| C36 | C-6 | R12 | B-5 | U21 | F-3 | | |
| C37 | D-6 | R13 | B-5 | U22 | G-3 | W1 | H-5 |
| C38 | D-6 | R14 | C-5 | U23 | H-3 | W2 | H-5 |
| C39 | E-6 | R15 | C-5 | U24 | A-3 | | |
| C40 | G-6 | R16 | C-5 | U25 | B-3 | | |
| C41 | G-6 | R17 | E-6 | U26 | C-3 | | |
| C42 | H-6 | R18 | E-6 | U27 | E-3 | | |
| C43 | H-6 | R19 | I-2 | U28 | F-3 | | |
| C44 | I-6 | | | U29 | G-3 | | |
| C45 | J-6 | | | U30 | H-3 | | |
| C46 | F-7 | RP1 | G-6 | U31 | A-4 | | |
| C47 | J-3 | RP2 | H-6 | U32 | B-4 | | |

Figure M3-9 GRAPHICS PCB Assembly 16922

ASSEMBLY 16922
REF. DESIG. ARE ABBREVIATED
WITH PREFIX A11

P1
25LS2521 U59
RP1 10K
S1
74LS138 U58
U49 14L8 PAL
74LS164 U52
74LS38 U56A
74LS38 U56B
R18 4.7K
74LS74 U55A
74LS645 XCVR U63
R19 1K
TP2
TP1
C46 10
U44 7220AD
R1 1K

74HCT32 U35A
74HCT32 U35B
74LS1004 U34A
74LS1004 U34B
74LS1004 U34C
74ACT08 U17A
74ACT08 U17B
74ACT08 U17C
74ACT08 U17D
74ACT175 U45
74ACT175 U24
28.7539MHZ Y1
74LS1004 U34D
74LS161 U1
74LS164 U57
74S37 U47A
74S37 U47B
74LS00 U53A
74LS00 U53B
74HCT20 U8A
74LS74 U55B
74LS00 U53C
74S37 U47C
74LS1004 U34E
74LS74 U48A
74LS74 U48B
74LS74 U54A
74LS00 U53D
74S37 U47D
74LS1004 U34F
74HCT373 U60

P2
A28 HORIZ SYNC
A27 VERT SYNC
B32 BLANKING

PLANE 1
PLANE 2
PLANE 3
PLANE 4
(SH 4)
SER4 (SH 2)
SER3 (SH 3)
SER2 (SH 3)
SER1 (SH 2)
PIXCLK (SH 2, 3)
RAS (SH 2, 3)
ROWSEL (SH 2)
CAS (SH 2, 3)
VSREQ (SH 2, 3)
DBIN (SH 2)
ENTRANS (SH 2, 3)
ENTRANS (SH 2, 3)
WAV (SH 2)
AA17 (SH 2)
AA16 (SH 2)
AA15 (SH 2)
AD0 - AD15 (SH 2, 3)

DATA BUS (SH 4)
(SH 4)
WR
COLOR
BR COLOR
DSO
WRITE
SYSCLK
IACKIN
IACKOUT
DTACK
DGND
BG0IN
BG0OUT
BG1IN
BG1OUT
BG2IN
BG2OUT
BG3IN
BG3OUT

U1 74LS161 C6 .01 U8 74HCT20 U17 74ACT08 C10 .01 U24 74ACT175 U34 74LS1004 C12 .01 U35 74HCT32
U44 7220AD C47 .01 U45 74ACT175 C24 .01 U46 74HCT32 C25 .01 U47 74S37 U48 74LS74 C27 .01 U49 14L8 C28 .01
U52 74LS164 C31 .01 U53 74LS00 C37 .01 U54 74LS74 C38 .01 U55 74LS74 U56 74LS38 C39 .01 U57 74LS164
U58 74LS138 C40 .01 U59 25LS2521 C41 .01 U60 74HCT373 C42 .01 U63 74LS645 C45 .01

NOTES: (UNLESS OTHERWISE SPECIFIED)
1. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
2. ALL CAPACITORS ARE IN MICROFARADS, 50V, 20%.

| | | |
|---|---|---|
| DRAWN M. LE | DATE 12/13/88 | WAVETEK MICROWAVE, INC. SANTA CLARA, CALIFORNIA |
| CHECKED D. WATSON | 12-8-89 | GRAPHICS |
| ENG G. Torngvist | 2-8-89 | |
| MFG ENG H. Kotzen | 12-7-89 | 16923 G |
| | | SHEET 1 OF 4 |

PIXCLK (SH 1, 2)
VSHLD (SH 1, 2)
NA4 (SH 2)
AD3 (SH 2)
ENTRANS (SH 1, 2)
NA3 (SH 2)
RD4 (SH 2)
CAS (SH 1, 2)
RAS (SH 1, 2)
AD0-AD15 (SH 1, 2)
A0-A7 (SH 2)

74LS245 U43 XCVR
74LS245 U42 XCVR
74LS08 U51C
TMS4464 U30 U23 U14 U7 RAM
74LS245 U39 U38 XCVR
74LS08 U51D
TMS4464 U28 U21 U12 U5 RAM
74ACT166 U26 U10 U19 U3 SR

+5V

SER 3 (SH 1)
SER 4 (SH 1)

+5V
U3, U10 74ACT166 — C7 .01
U19, U26 74ACT166 — C11 .01
U5, U12 U21, U28 TMS4464 — C3 .01
U51 74LS08 — C30 .01
U7, U14 U23, U30 TMS4464 — C5 .01

| | | |
|---|---|---|
| DRAWN M. LE | DATE 12/15/88 | WAVETEK MICROWAVE, INC. SUNNYVALE CALIFORNIA |
| CHECKED D. WATSON | 12-8-89 | GRAPHICS |
| G. Tormasi | 12-8-89 | |
| MFG ENG H. Kehm | 12-7-89 | DRAWING NO 16923 REV G |
| | | SHEET 3 OF 4 |

PIXCLK (SH 1, 3)
VSRLD (SH 1, 3)
AA17 (SH 1)
AA15 (SH 1)
WRV (SH 1)
RA4 (SH 3)
RA3 (SH 3)
AA16 (SH 1)
DBIN (SH 1)
RD4 (SH 3)
RD3 (SH 3)
ENTRANS (SH 1, 3)
ENTRANS (SH 1, 3)
CAS (SH 1, 3)
RAS (SH 1, 3)
AD0-AD15 (SH 1, 3)
ROWSEL (SH 1)
A0-A7 (SH 3)
SER 1 (SH 1)
SER 2 (SH 1)
+5V
W1
W2
74LS139 U50A DCDR/DMUXR
74LS139 U50B DCDR/DMUXR
74LS245 XCVR U41
74LS245 XCVR U46
74LS245 XCVR U36
74LS245 XCVR U37
74LS08 U51A
74LS08 U51B
TMS4464 RAM U29
TMS4464 RAM U22
TMS4464 RAM U13
TMS4464 RAM U6
TMS4464 RAM U27
TMS4464 RAM U22
TMS4464 RAM U13
TMS4464 RAM U4
74ACT166 SR U25
74ACT166 SR U9
74ACT166 SR U18
74ACT166 SR U2
74LS257 MUXR U16
74LS257 MUXR U15
U2, U9 74ACT166
U4, U11, U20, U27 TMS4464
U6, U13, U22, U29 TMS4464
U15, U16 74LS257
U18, U25 74ACT166
U36, U37 74LS245
U50 74LS139
U38, U39 U40, U41 U42, U43 74LS245
C1 .01
C2 .01
C4 .01
C8 .01
C9 .01
C13 .01
C29 .01
C14 .01

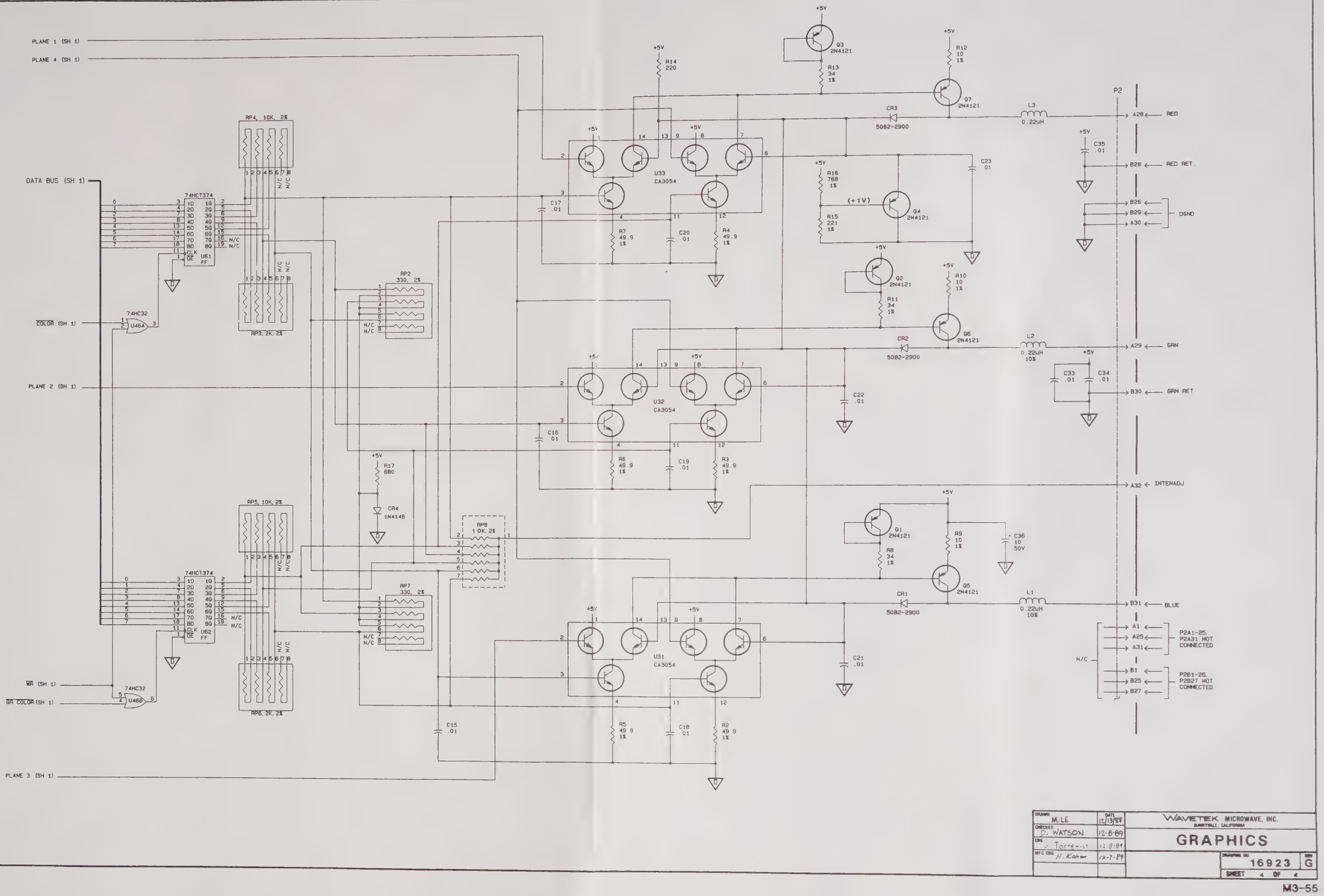
| | | | |
|---|---|---|---|
| DRAWN | M. LE | DATE | 12/15/88 |
| CHECKED | D. WATSON | | 12-8-89 |
| ENG | G Torgrimt | | 12-8-89 |
| MFG ENG | N. Kirton | | 12 7 89 |

WAVETEK MICROWAVE, INC. SUNNYVALE, CALIFORNIA

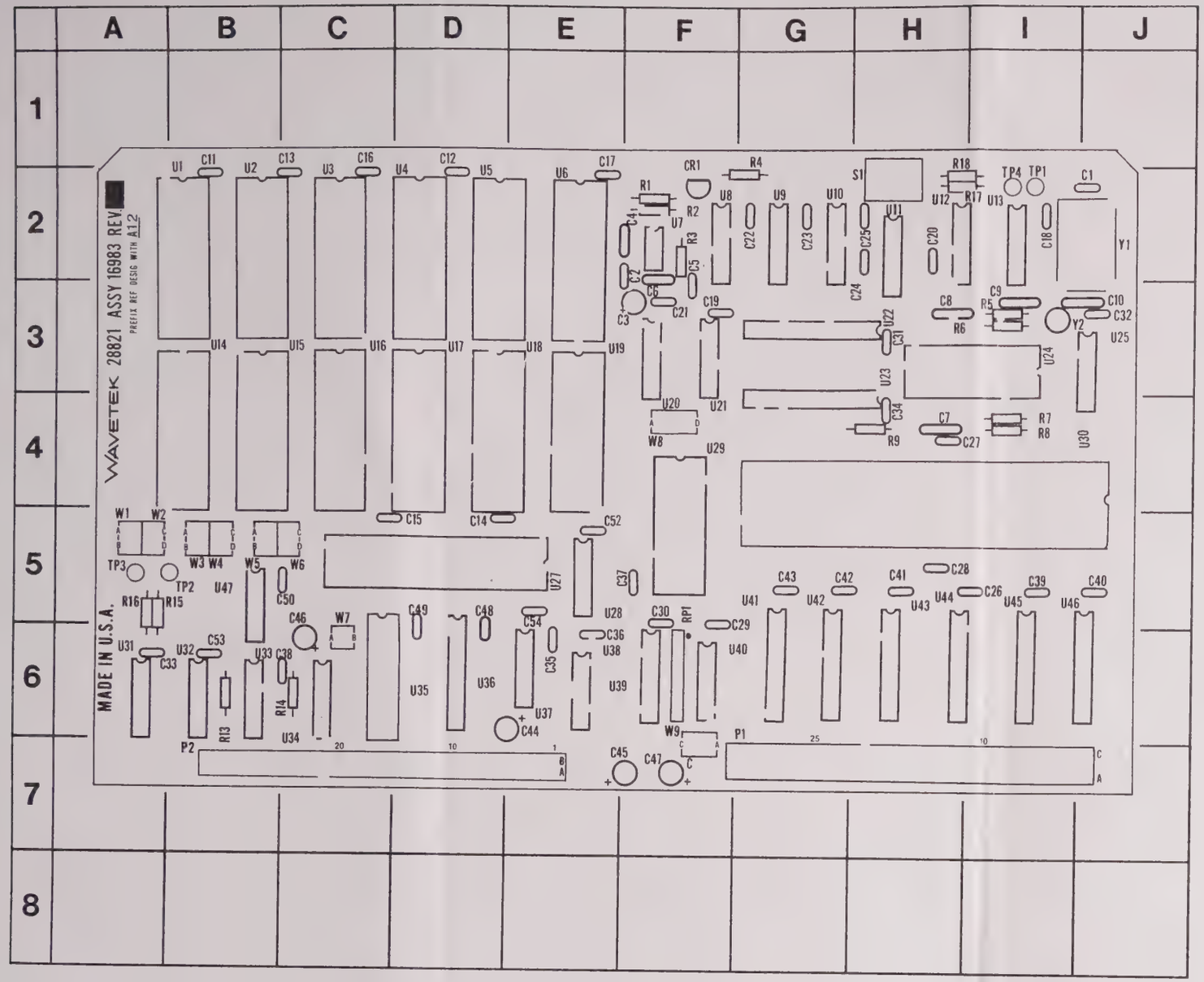
GRAPHICS

16923 REV G

SHEET 2 OF 4



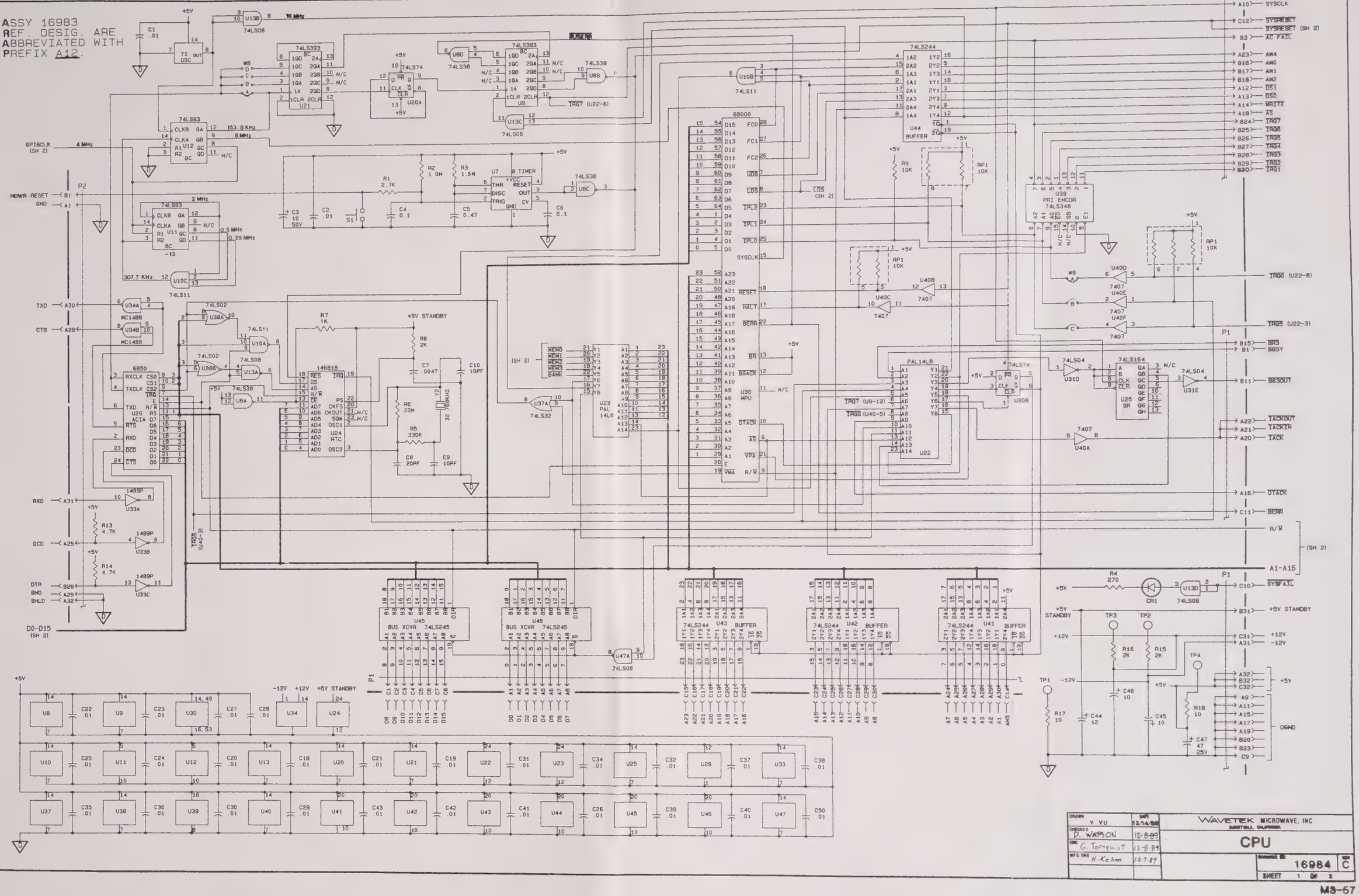

| | | | |
|---|---|---|---|
| DRAWN M.LE | DATE 12/13/89 | WAVETEK MICROWAVE, INC. SUNNYVALE, CALIFORNIA | |
| CHECKED D. WATSON | 12-8-89 | GRAPHICS | |
| ENG J. Torguist | 12-8-89 | DRAWING NO 16923 | REV G |
| MFG ENG N. Kahan | 12-7-89 | SHEET 4 OF 4 | |




| CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC |
|---|---|---|---|---|---|---|---|
| C1 | J-2 | C48 | D-6 | U1 | B-2 | Y1 | J-2 |
| C2 | F-2 | C49 | D-6 | U2 | B-2 | Y2 | I-3 |
| C3 | F-3 | C50 | B-5 | U3 | C-2 | | |
| C4 | F-2 | C51 | | U4 | D-2 | | |
| C5 | F-3 | C52 | E-5 | U5 | D-2 | W1 | A-5 |
| C6 | F-3 | C53 | B-6 | U6 | E-2 | W2 | A-5 |
| C7 | H-4 | C54 | E-5 | U7 | F-2 | W3 | B-5 |
| C8 | H-3 | | | U8 | F-2 | W4 | B-5 |
| C9 | I-3 | | | U9 | G-2 | W5 | B-5 |
| C10 | J-3 | CR1 | F-2 | U10 | G-2 | W6 | C-5 |
| C11 | B-2 | | | U11 | H-2 | W7 | C-6 |
| C12 | D-2 | | | U12 | H-2 | W8 | F-4 |
| C13 | C-2 | P1 | G-7 | U13 | I-2 | W9 | F-7 |
| C14 | D-5 | P2 | B-7 | U14 | B-4 | | |
| C15 | C-5 | | | U15 | B-4 | | |
| C16 | C-2 | | | U16 | C-4 | | |
| C17 | E-2 | R1 | F-2 | U17 | D-4 | | |
| C18 | I-2 | R2 | F-2 | U18 | D-4 | | |
| C19 | F-3 | R3 | F-2 | U19 | E-4 | | |
| C20 | H-2 | R4 | G-2 | U20 | F-3 | | |
| C21 | F-3 | R5 | I-3 | U21 | F-3 | | |
| C22 | G-2 | R6 | I-3 | U22 | G-3 | | |
| C23 | G-2 | R7 | I-4 | U23 | G-4 | | |
| C24 | H-2 | R8 | I-4 | U24 | I-3 | | |
| C25 | H-2 | R9 | H-4 | U25 | J-3 | | |
| C26 | I-5 | R10 | | U26 | | | |
| C27 | H-4 | R11 | | U27 | E-5 | | |
| C28 | H-5 | R12 | | U28 | E-5 | | |
| C29 | F-6 | R13 | B-6 | U29 | F-4 | | |
| C30 | F-6 | R14 | C-6 | U30 | J-4 | | |
| C31 | H-3 | R15 | A-5 | U31 | A-6 | | |
| C32 | J-3 | R16 | A-5 | U32 | B-6 | | |
| C33 | A-6 | R17 | H-2 | U33 | B-6 | | |
| C34 | H-4 | R18 | H-2 | U34 | C-6 | | |
| C35 | E-6 | | | U35 | C-6 | | |
| C36 | E-6 | | | U36 | D-6 | | |
| C37 | F-5 | RP1 | F-6 | U37 | E-6 | | |
| C38 | B-6 | | | U38 | E-6 | | |
| C39 | I-5 | | | U39 | F-6 | | |
| C40 | J-5 | S1 | H-2 | U40 | F-6 | | |
| C41 | H-5 | | | U41 | G-6 | | |
| C42 | G-5 | | | U42 | G-6 | | |
| C43 | G-5 | TP1 | I-2 | U43 | H-6 | | |
| C44 | E-6 | TP2 | B-5 | U44 | H-6 | | |
| C45 | F-7 | TP3 | A-5 | U45 | I-6 | | |
| C46 | C-6 | TP4 | I-2 | U46 | J-6 | | |
| C47 | F-7 | | | U47 | B-5 | | |

Figure M3-10 CPU PCB Assembly 16983

ASSY 16983
REF. DESIG. ARE
ABBREVIATED WITH
PREFIX A12.


74LS08
74LS393
74LS74
74LS38
74LS93
74LS11
74LS02
74LS08
74LS10
74LS32
74LS00
74LS244
74LS348
74LS164
74LS04
74LS14
74LS245
74LS240
74LS241
74LS374
74LS540
74LS541
74LS640
74LS645
74LS373
74LS138
74LS139
74LS148
74LS151
74LS153
74LS157
74LS158
74LS160
74LS161
74LS162
74LS163
74LS165
74LS166
74LS168
74LS169
74LS170
74LS173
74LS174
74LS175
74LS181
74LS182
74LS190
74LS191
74LS192
74LS193
74LS194
74LS195
74LS196
74LS197
74LS221
74LS240
74LS242
74LS243
74LS244
74LS245
74LS247
74LS248
74LS249
74LS251
74LS253
74LS257
74LS258
74LS259
74LS260
74LS261
74LS266
74LS273
74LS280
74LS283
74LS290
74LS293
74LS295
74LS298
74LS299
74LS322
74LS323
74LS347
74LS348
74LS352
74LS353
74LS354
74LS355
74LS356
74LS357
74LS365
74LS366
74LS367
74LS368
74LS373
74LS374
74LS375
74LS377
74LS378
74LS379
74LS382
74LS384
74LS385
74LS386
74LS390
74LS393
74LS395
74LS396
74LS398
74LS399
74LS424
74LS425
74LS426
74LS427
74LS428
74LS429
74LS430
74LS431
74LS432
74LS433
74LS434
74LS435
74LS436
74LS437
74LS438
74LS439
74LS440
74LS441
74LS442
74LS443
74LS444
74LS445
74LS446
74LS447
74LS448
74LS449
74LS450
74LS451
74LS452
74LS453
74LS454
74LS455
74LS456
74LS457
74LS458
74LS459
74LS460
74LS461
74LS462
74LS463

ADDRESS BUS

DATA BUS

(SH 1) A17

(SH 1) MEMO

(SH 1) BANK

(SH 1) A16

(SH 1) MEM 1

(SH 1) MEM 2

74LS04 U31A

74LS04 U31B

74LS04 U31C

74LS00 U32A

74LS00 U32B

74LS00 U32C

U14 D27256 ROM

U1 D27256 ROM

U17 D27256 ROM

U4 D27256 ROM

U15 D27256 ROM

U2 D27256 ROM

U18 D27256 ROM

U5 D27256 ROM

U16 D27256 ROM

U3 D27256 ROM

U19 D27256 ROM

U6 D27256 ROM

W1 W2 W3 W4 W5 W6 +5V

74LS32 U28A U28B U28C

MEMO BANK (SH 1)

MEM1 (SH 1)

A16 (SH 1)

MEM 2 (SH 1)

TMS9914

D0-D15

(SH 1) R/W

LDS

A1-A16

(SH 1) GPIB CLK SYSRESET IRQG BANK MEM3

74LS32 U37C U37B U37D

BUFFER 75160 U36

BUFFER 75162 U35

P2

A19 DIO1 A18 DIO2 A17 DIO3 A16 DIO4 B19 DIO5 B18 DIO6 B17 DIO7 B16 DIO8

A10 SRQ A9 ATN A15 EOI A14 DAV A13 NRFD A12 NDAC A11 IFC B15 REN

B8 B9 B10 B11 B12 B13 B14 A8 — D COM

W7

+5V

U27 U36 U35 U31 U28 U32 C54 .01 C48 .01 C49 .01 C33 .01 C52 .01 C53 .01

U14 U1 U15 U2 U16 U3 C11 .01 C13 .01 C15 01 C16 01

U17 U4 U18 U5 U19 U6 C12 01 C14 01 C17 01

NOTES: (UNLESS OTHERWISE SPECIFIED)

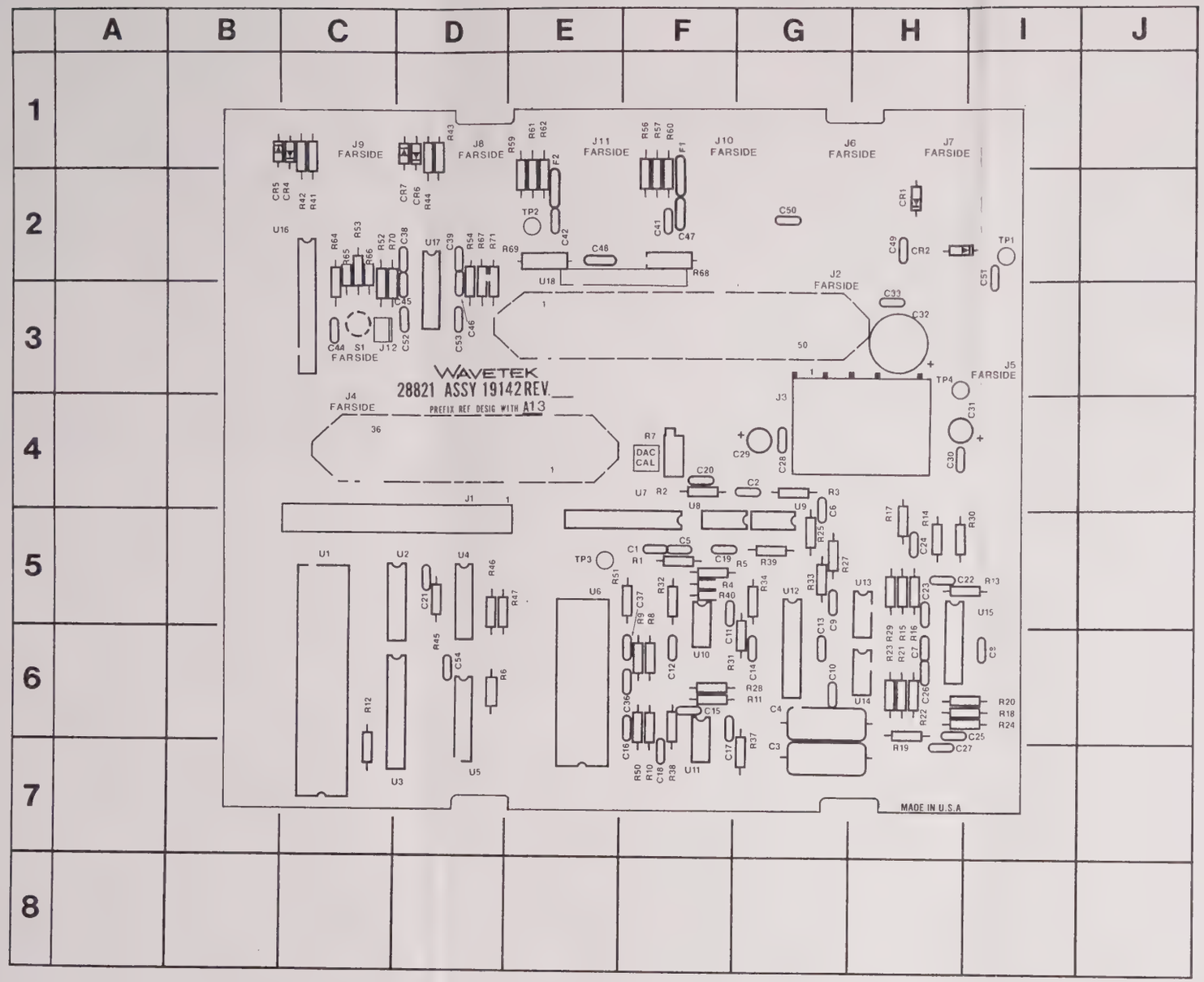
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS, 50V, 20%.

| | | | |
|---|---|---|---|
| DRAWN | V. Vu | DATE | 12/14/88 |
| CHECKED | D. WATSON | | 12-8-89 |
| ENG | S Torgeson | | 12-8-89 |
| MFG ENG | N Kashani | | 12-7-89 |

WAVETEK MICROWAVE, INC
SUBTITLE: CPU

DWG NO 16984 REV C

SHEET 2 OF 2




| CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC |
|---|---|---|---|---|---|---|---|
| C1 | F-5 | C48 | E-2 | R12 | C-7 | R59 | E-2 |
| C2 | G-4 | C49 | H-2 | R13 | I-5 | R60 | F-2 |
| C3 | G-7 | C50 | G-2 | R14 | H-5 | R61 | E-2 |
| C4 | G-6 | C51 | I-3 | R15 | H-5 | R62 | E-2 |
| C5 | F-5 | C52 | D-3 | R16 | H-5 | R63 | |
| C6 | G-5 | C53 | D-3 | R17 | H-5 | R64 | C-3 |
| C7 | H-6 | C54 | D-6 | R18 | I-6 | R65 | C-2 |
| C8 | I-6 | | | R19 | I-6 | R66 | C-2 |
| C9 | G-5 | | | R20 | I-6 | R67 | D-3 |
| C10 | G-6 | CR1 | H-2 | R21 | H-6 | R68 | F-2 |
| C11 | F-5 | CR2 | H-2 | R22 | H-6 | R69 | E-2 |
| C12 | F-6 | CR3 | | R23 | H-6 | R70 | C-3 |
| C13 | G-6 | CR4 | C-1 | R24 | I-6 | R71 | D-3 |
| C14 | G-6 | CR5 | B-1 | R25 | G-5 | | |
| C15 | F-6 | CR6 | D-1 | R26 | | | |
| C16 | F-6 | CR7 | D-1 | R27 | G-5 | S1 | C-3 |
| C17 | F-6 | | | R28 | F-6 | | |
| C18 | F-7 | | | R29 | H-5 | | |
| C19 | F-5 | F1 | F-2 | R30 | H-5 | TP1 | I-2 |
| C20 | F-4 | F2 | E-2 | R31 | G-6 | TP2 | E-2 |
| C21 | D-5 | | | R32 | F-5 | TP3 | E-5 |
| C22 | H-5 | | | R33 | G-5 | TP4 | H-4 |
| C23 | H-5 | J1 | D-5 | R34 | G-5 | | |
| C24 | H-5 | J2 | F-3 | R35 | | | |
| C25 | H-6 | J3 | G-4 | R36 | | U1 | C-5 |
| C26 | H-6 | J4 | C-4 | R37 | G-7 | U2 | C-5 |
| C27 | H-7 | J5 | I-3 | R38 | F-6 | U3 | C-6 |
| C28 | G-4 | J6 | G-2 | R39 | G-5 | U4 | D-5 |
| C29 | G-4 | J7 | H-2 | R40 | F-5 | U5 | D-6 |
| C30 | H-4 | J8 | D-2 | R41 | C-1 | U6 | E-6 |
| C31 | H-4 | J9 | C-2 | R42 | C-1 | U7 | F-5 |
| C32 | H-3 | J10 | F-2 | R43 | D-1 | U8 | F-5 |
| C33 | H-3 | J11 | E-1 | R44 | D-1 | U9 | G-5 |
| C34 | | J12 | C-3 | R45 | D-5 | U10 | F-6 |
| C35 | | | | R46 | D-5 | U11 | F-7 |
| C36 | F-6 | | | R47 | D-5 | U12 | G-6 |
| C37 | F-6 | R1 | F-5 | R48 | | U13 | H-5 |
| C38 | D-2 | R2 | F-4 | R49 | | U14 | H-6 |
| C39 | D-2 | R3 | G-4 | R50 | F-6 | U15 | H-5 |
| C40 | | R4 | F-5 | R51 | F-5 | U16 | C-2 |
| C41 | F-2 | R5 | F-5 | R52 | D-3 | U17 | D-3 |
| C42 | E-2 | R6 | D-6 | R53 | C-2 | U18 | E-3 |
| C43 | | R7 | F-4 | R54 | D-3 | | |
| C44 | C-3 | R8 | F-6 | R55 | | | |
| C45 | D-3 | R9 | F-6 | R56 | F-2 | | |
| C46 | D-3 | R10 | F-6 | R57 | F-2 | | |
| C47 | F-2 | R11 | F-6 | R58 | | | |

Figure M3-11 REAR PANEL PCB Assembly 19142

ASSY 19142
REF DESIG ABBREVIATED WITH PREFIX A13

FLOPPY DISK PORT

J4

TO DIGITAL INTERCONNECT

J1

J2

MS20X SOURCE CONNECTOR

BUS ENABLE

U1 PPI

U2 74HCT74

U3 16L8 PAL

U4 74HCT03

U5 74LS00

U6 8255

U8 5135-5

U9 5135-5

U10 5135-5

U11 5135-5

AD574A

AD7534

AD7537

U12 DG201

U13 LF398

U14 LF398

U15A MC34074A

U15B MC34074A

U16A LM2878

U16B LM2878

U17A MC34074A

U17B MC34074A

U17C MC34074A

U18A LM2878

U18B LM2878

74LS00

F1 PTC FUSE

F2 PTC FUSE

J5 DAC OUT

J6 SWEEP IN

J7 V ∝ F IN

J10 BIAS OUTPUT

J11 AC MOD OUTPUT

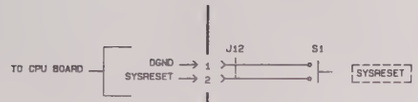
J8 BLANKING INPUT

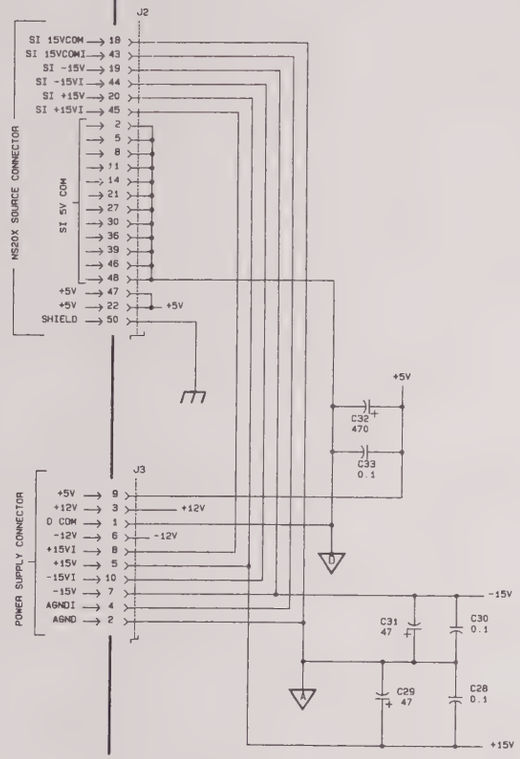
J9 INPUT1 TTL LEVELS

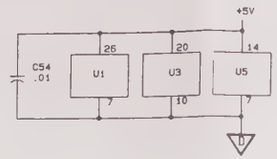
NOTES: (UNLESS OTHERWISE SPECIFIED)
1. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, 5%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.

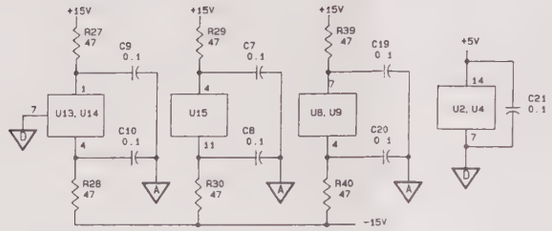
| | | |
|---|---|---|
| DRAWN J. BAUER | DATE 2-1-89 | WAVETEK MICROWAVE, INC. SUNNYVALE, CALIFORNIA |
| CHECKED D. WATSON | 12-8-89 | REAR PANEL |
| ENG H Kahm | 12-7-89 | |
| MFG ENG H Kahm | 12-7-89 | 19143 D |
| | | SHEET 1 OF 2 |

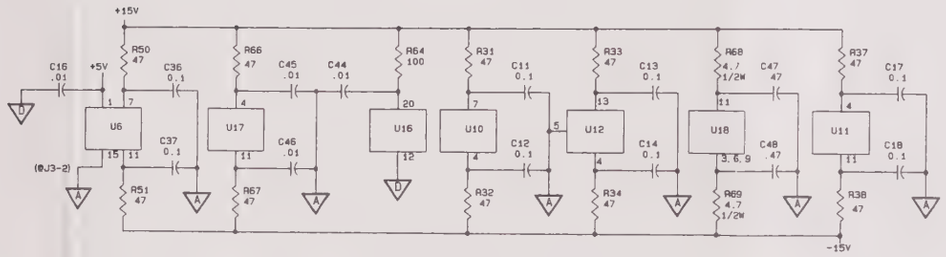
M3-61




| | | | |
|---|---|---|---|
| DRAWN J. BAUER | DATE 2/1/89 | WAVETEK MICROWAVE, INC. SUNNYVALE, CALIFORNIA | |
| CHECKED D. WATSON | 12-8-89 | REAR PANEL | |
| ENG G. Torquist | 12-8-89 | DRAWING NO 19143 | REV D |
| MFG ENG N. Kahan | 12-7-89 | SHEET 2 OF 2 | |

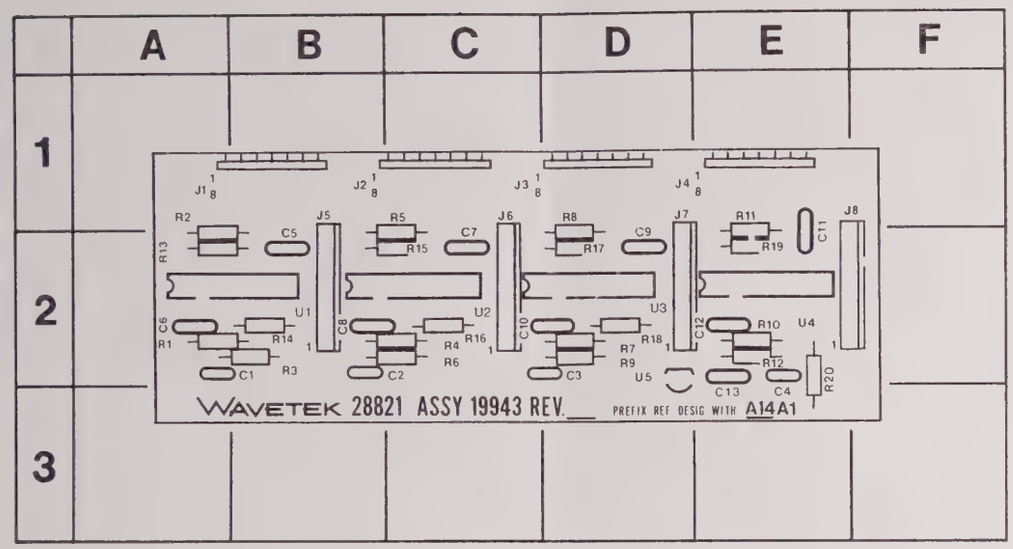
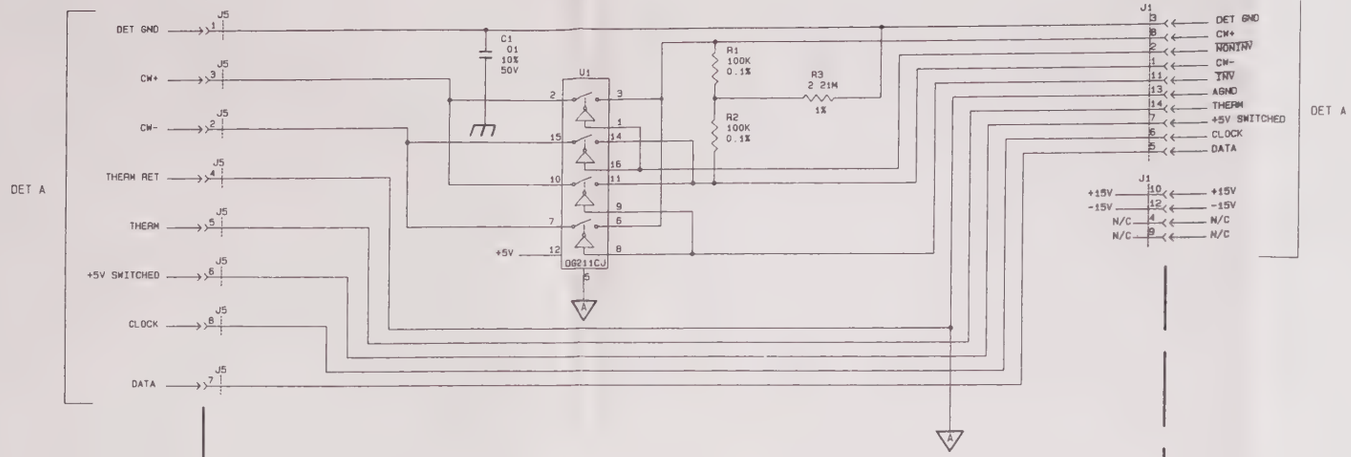
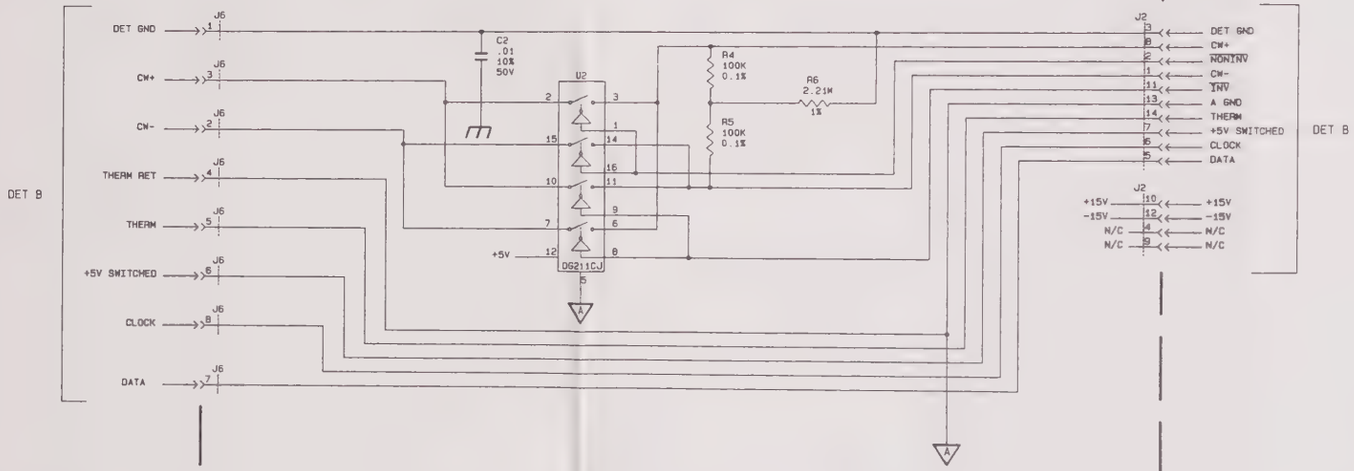
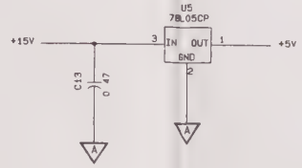



Figure M3-12 MODULATOR PCB Assembly 19943

| CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC | CKT REF | GRID LOC |
|---|---|---|---|---|---|---|---|---|---|
| C1 | A-2 | C13 | E-2 | R1 | A-2 | R13 | A-2 | U3 | D-2 |
| C2 | B-2 | | | R2 | A-2 | R14 | B-2 | U4 | E-2 |
| C3 | D-2 | | | R3 | B-2 | R15 | C-2 | U5 | D-2 |
| C4 | E-2 | J1 | B-1 | R4 | C-2 | R16 | C-2 | | |
| C5 | B-2 | J2 | C-1 | R5 | C-2 | R17 | D-2 | | |
| C6 | A-2 | J3 | D-1 | R6 | C-2 | R18 | D-2 | | |
| C7 | C-2 | J4 | E-1 | R7 | D-2 | R19 | E-2 | | |
| C8 | B-2 | J5 | B-2 | R8 | D-2 | R20 | E-2 | | |
| C9 | D-2 | J6 | C-2 | R9 | D-2 | | | | |
| C10 | D-2 | J7 | D-2 | R10 | E-2 | | | | |
| C11 | E-2 | J8 | F-2 | R11 | E-2 | U1 | B-2 | | |
| C12 | E-2 | | | R12 | E-2 | U2 | C-2 | | |



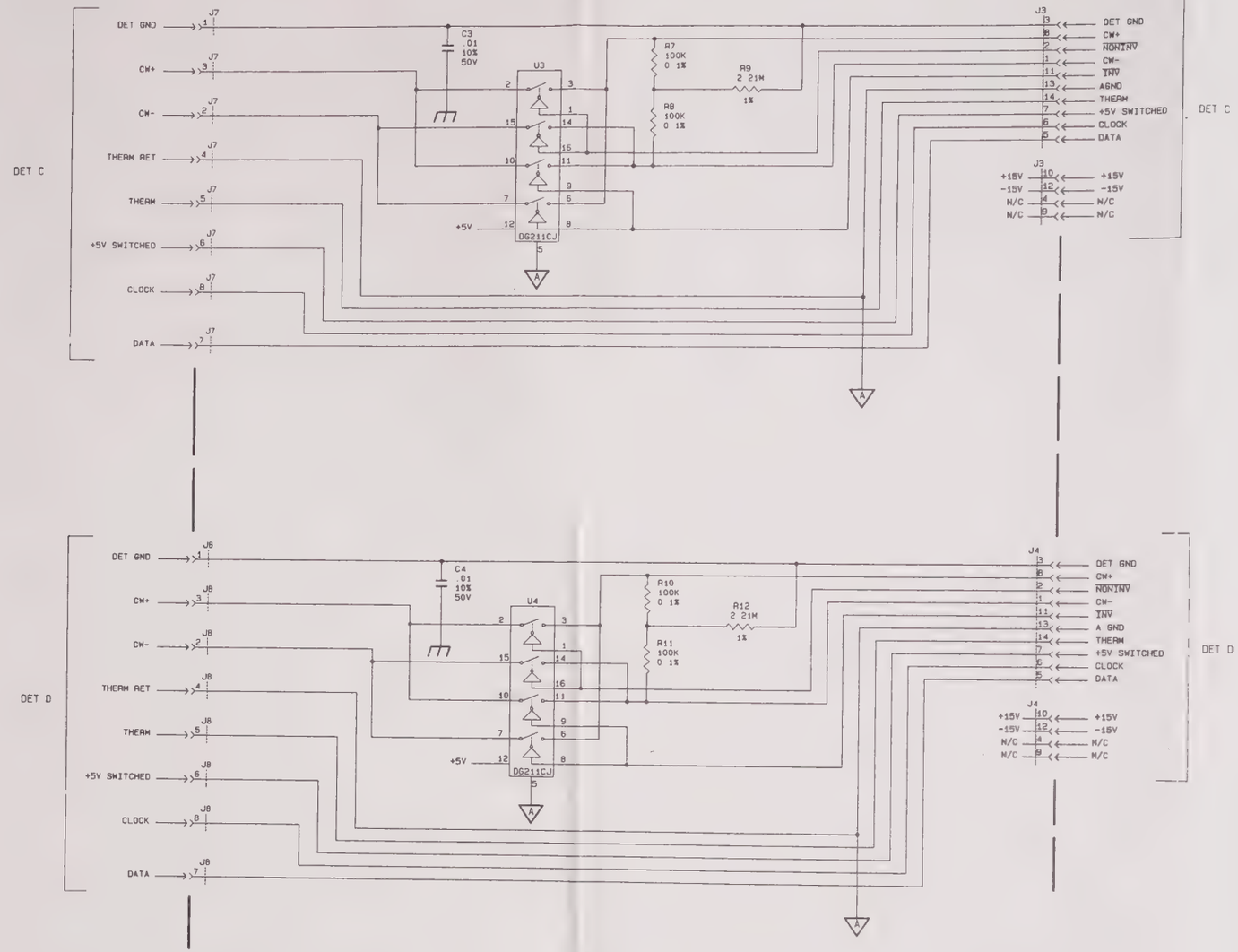



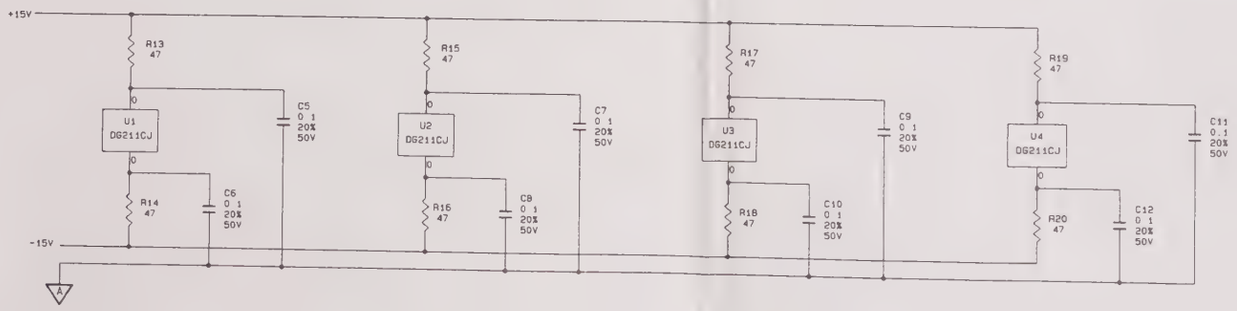




NOTES: (UNLESS OTHERWISE SPECIFIED)

1. RESISTOR VALUES ARE IN OHMS, ±5%, 1/8W.
2. CAPACITOR VALUES ARE IN MICROFARADS, ±10%, 50V.
3. INDUCTOR VALUES ARE IN MICROHENERYS.
4. POTENTIOMETER ARROW INDICATES CW ROTATION.

| | | |
|---|---|---|
| DRAWN: MINH LE | DATE: 6-1-89 | WAVETEK MICROWAVE, INC. SUNNYVALE, CALIFORNIA |
| CHECKED: D. WATSON | 12-8-89 | MODULATOR |
| ENG: G Torriquez | 12-8-89 | |
| MFG ENG: H Kehm | 12-7-89 | DRAWING NO 19944 REV 5 |
| | | SHEET 1 OF 2 |




| | | |
|---|---|---|
| DRAWN MINH LE | DATE 6-1-89 | WAVETEK MICROWAVE, INC. SUNNYVALE CALIFORNIA |
| CHECKED D WATSON | 12-8-89 | MODULATOR |
| ENG C Tornquist | 12-6-89 | |
| MFG ENG H Kehm | 12-7-89 | DRAWING NO 19944 REV 5 |
| | | SHEET 2 OF 2 |

# CHAPTER M4

# REPLACEABLE PARTS LISTINGS


| Description | Page No. |
|---|---|
| Mainframe Assembly #19169 - Model 8003 | M4-2 |
| Power Supply PC Board Assembly #19175 (Board #A1) | M4-2 |
| CRT Cathode PC Board Assembly #19167 (Board #A2) | M4-10 |
| Front Panel PC Board Assembly #17228 (Board #A3) | M4-13 |
| Analog Interconnect PC Board Assembly #17231 (Board #A4) | M4-14 |
| Calibrator PC Board Assembly #17169 (Board #A5) | M4-15 |
| Analog PC Board Assembly #17288 (Board #A6) | M4-19 |
| Digital Interconnect PC Board Assembly #17707 (Board #A9) | M4-23 |
| Peripheral/Memory PC Board Assembly #17153 (Board #A10) | M4-24 |
| Graphics PC Board Assembly #16922 (Board #A11) | M4-26 |
| CPU PC Board Assembly #16983 (Board #A12) | M4-29 |
| Rear Panel PC Board Assembly #19142 (Board #A13) | M4-31 |
| Modulator PC Board Assembly #19943 (Board #A14A1) | M4-34 |
| CRT Socket PC Board Assembly #20038 (Board #A15) | M4-35 |

## MAINFRAME ASSEMBLY - MODEL 8003 #19169

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A1 | 19175 | POWER SUPPLY PCB ASSEMBLY | WAVETEK MICROWAVE | PER WMI #19175 |
| A2 | 19167 | CATHODE DRIVE PCB ASSEMBLY | WAVETEK MICROWAVE | PER WMI #19167 |
| A3 | 17228 | FRONT PANEL PCB ASSEMBLY | WAVETEK MICROWAVE | PER WMI #17228 |
| A4 | 17231 | ANALOG INTERCONNECT PC BD ASSY | WAVETEK MICROWAVE | PER WMI #17231 |
| A5 | 17169 | CALIBRATOR PCB ASSEMBLY | WAVETEK MICROWAVE | PER WMI #17169 |
| A6 | 17288 | ANALOG PCB ASSEMBLY | WAVETEK MICROWAVE | PER WMI #17288 |
| A9 | 17707 | DIGITAL INTERCON PCB ASSEMBLY | WAVETEK MICROWAVE | PER WMI #17707 |
| A10 | 17153 | PRPHL/MEMORY PCB ASSEMBLY | WAVETEK MICROWAVE | PER WMI #17153 |
| A11 | 16922 | GRAPHICS PCB ASSEMBLY | WAVETEK MICROWAVE | PER WMI #16922 |
| A12 | 16983 | CPU PC BOARD ASSEMBLY | WAVETEK MICROWAVE | PER WMI #16983 |
| A13 | 19142 | PCB ASSY REAR PANEL | WAVETEK MICROWAVE | PER WMI #19142 |
| A14 | 19954 | MODULATOR ASSY, 3 INPUT | WAVETEK MICROWAVE | PER WMI #19954 |
| A15 | 20038 | CRT SOCKET PCB ASSY | WAVETEK MICROWAVE | PER WMI #20038 |
| B1 | 20044 | FAN & CABLE ASSEMBLY | WAVETEK MICROWAVE | PER WMI #20044 |
| B2 | 17055 | STEPPER MOTOR ASSY | WAVETEK MICROWAVE | 17055 |
| F1 | 10064-005 | FUSE, 3A | LITTLEFUSE | 0 |
| L1 | 20137 | COIL, DEGAUSS | MINI MAGNETICS, INC. | PER WMI #20137 |
| L2 | 20137 | COIL, DEGAUSS | MINI MAGNETICS, INC. | PER WMI #20137 |
| LS1 | 17042 | SPEAKER, 2 INCH SQ | MOUSER ELECTRONICS | 25SP003 |
| R55 | 20087 | RES VAR FOCUS 20 MEG & 40 MEG | MURATA/ERIE CORP | MHF045-04A |
| W1 | 19588 | CABLE ASSY, CPU TO REAR PANEL | WAVETEK MICROWAVE | WMI #19588 |
| W2 | 19592 | CABLE ASSY,GRAPHICS TO CRT | WAVETEK MICROWAVE | PER WMI #19592 |
| W3 | 20139 | HARNESS, ARGO MAIN | WAVETEK MICROWAVE | PER WMI #20139 |
| W4 | 20138 | HARNESS, ARGO REAR PANEL | WAVETEK MICROWAVE | PER WMI #20138 |
| W5 | 20045 | CABLE ASSEMBLY, RF | WAVETEK MICROWAVE | PER WMI #20045 |
| W6 | 19957 | CABLE ASSY, CHOP-ANL INTCON | WAVETEK MICROWAVE | PER WMI #19957 |
| W7 | 19957 | CABLE ASSY, CHOP-ANL INTCON | WAVETEK MICROWAVE | PER WMI #19957 |
| W8 | 19957 | CABLE ASSY, CHOP-ANL INTCON | WAVETEK MICROWAVE | PER WMI #19957 |
| W10 | 19596 | CABLE ASSY, PWR SPLY-CRT CATH | WAVETEK MICROWAVE | PER WMI #19596 |
| W12 | 19590 | CABLE ASSY,FR PCB-ANLG INTCON | WAVETEK MICROWAVE | PER WMI #19590 |
| W14 | 19589 | CABLE ASSY,PER/MEM TO REAR PNL | WAVETEK MICROWAVE | PER WMI #19589 |
| W15 | 19591 | CABLE ASSY,PER/MEM-ANLG INTCON | WAVETEK MICROWAVE | PER WMI #19591 |
| W16 | 20114 | CABLE ASSY, SPEAKER-BATTERY | WAVETEK MICROWAVE | PER WMI #20114 |
| W17 | 20135 | CABLE ASSEMBLY, CRT (VC/VH) | WAVETEK MICROWAVE | PER WMI #20135 |
| W18 | 20136 | CABLE ASSY, CRT (HC/HH/GND) | WAVETEK MICROWAVE | PER WMI #20136 |
| W19 | 20283 | CABLE ASSY, DEGAUSS | WAVETEK MICROWAVE | PER WMI #20283 |

## POWER SUPPLY PC BOARD ASSEMBLY #19175

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A1C1 | 19598-004 | CAP ELCTLT RDL 3300uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E332MRA |
| A1C2 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C3 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A1C4 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C5 | 19599-007 | CAP ELCTLT RDL 22uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H220MAA |
| A1C6 | 19998-001 | CAP ELCTLT RDL 2000uF 20% 200V | MARCON AMERICA CORP | CETSU2D202M |
| A1C7 | 15776-018 | CAP, Ceramic,4700pF X7R, 50V | CENTRALAB | CW15C472K |
| A1C8 | 19998-001 | CAP ELCTLT RDL 2000uF 20% 200V | MARCON AMERICA CORP | CETSU2D202M |
| A1C9 | 15776-010 | CAP, CER .22UF 10% 50V | CENTRALAB | CW30C224K |
| A1C10 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A1C11 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A1C12 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C13 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C14 | 15776-003 | CAP,CER .022 MFD 10% 50V | CENTRALAB | CW15C223K |
| A1C15 | 15776-018 | CAP, Ceramic,4700pF X7R, 50V | CENTRALAB | CW15C472K |
| A1C16 | 15776-018 | CAP, Ceramic,4700pF X7R, 50V | CENTRALAB | CW15C472K |
| A1C17 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A1C18 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C19 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C20 | 15776-013 | CAP CER 220PF 10% 50V | CENTRALAB | CW15C221K |
| A1C21 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C23 | 20032-002 | CAP MET POLY 4.7MF 10% 160V | WIMA | MKP 4 |
| A1C25 | 20032-002 | CAP MET POLY 4.7MF 10% 160V | WIMA | MKP 4 |
| A1C28 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A1C29 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A1C30 | 10909-004 | CAP MICA 2400PF 1% 500V | ARCO | CM06FD242F03 |
| A1C31 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C32 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A1C33 | 15776-018 | CAP, Ceramic,4700pF X7R, 50V | CENTRALAB | CW15C472K |
| A1C34 | 20241-001 | CAP ELCTLT RDL 1uF 20% 160V | UNITED CHEMICON CORPORATI | KMC160VB1ROM6X11LL |
| A1C35 | 20241-002 | CAP ELCTLT RDL 33uF 20% 160V | UNITED CHEMICON CORPORATI | KMC160VB33RM12X25LL |
| A1C36 | 19599-002 | CAP ELCTLT RDL 100uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H101MPA |
| A1C37 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C38 | 19598-001 | CAP ELCTLT RDL 470uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E471MRA |
| A1C39 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C40 | 15776-008 | CAP CER .047 MFD 10% 50V | CENTRALAB | CW20C473K |
| A1C41 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C42 | 19599-004 | CAP ELCTLT RDL 4.7uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H4R7MAA |
| A1C43 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C44 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C45 | 19598-001 | CAP ELCTLT RDL 470uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E471MRA |
| A1C46 | 15776-008 | CAP CER .047 MFD 10% 50V | CENTRALAB | CW20C473K |
| A1C47 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C48 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C49 | 19598-005 | CAP ELCTLT RDL 2200uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E222MRA |
| A1C50 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C51 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C52 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C53 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C54 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A1C55 | 19598-005 | CAP ELCTLT RDL 2200uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E222MRA |
| A1C56 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C57 | 19599-004 | CAP ELCTLT RDL 4.7uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H4R7MAA |
| A1C58 | 15776-028 | CAP CER 100PF 10% 50V | CENTRALAB | CW20C101K |
| A1C59 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C60 | 19599-006 | CAP ELCTLT RDL 47uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H470MAA |
| A1C61 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C62 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A1C63 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C64 | 16258-003 | CAP METAL POLY 0.47UF 10% 63V | WIMA | MKS2-0.47-63-10 |
| A1C65 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C66 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A1C67 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C68 | 19598-002 | CAP ELCTLT RDL 47uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E470MAA |
| A1C69 | 15776-028 | CAP CER 100PF 10% 50V | CENTRALAB | CW20C101K |
| A1C70 | 15776-008 | CAP CER .047 MFD 10% 50V | CENTRALAB | CW20C473K |
| A1C72 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C73 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C74 | 16258-003 | CAP METAL POLY 0.47UF 10% 63V | WIMA | MKS2-0.47-63-10 |
| A1C75 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A1C76 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A1C77 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C78 | 16258-005 | CAP, METAL POLY 2.2uF 10% 50V | WIMA | MKS2-2.2-50-10 |
| A1C79 | 19599-002 | CAP ELCTLT RDL 100uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H101MPA |
| A1C80 | 19599-003 | CAP ELCTLT RDL 1.0uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H010MAA |
| A1C81 | 20506-001 | CAP CER .022MF 10% 100V | CENTRALAB | CW20A223K |
| A1C82 | 15640-011 | CAP CER USTBLE 4700pF 10% 100V | MURATA/ERIE CORP | RPE113C00472K100V |
| A1C83 | 15640-011 | CAP CER USTBLE 4700pF 10% 100V | MURATA/ERIE CORP | RPE113C00472K100V |
| A1C84 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A1C85 | 19599-003 | CAP ELCTLT RDL 1.0uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H010MAA |
| A1C86 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A1C87 | 19599-004 | CAP ELCTLT RDL 4.7uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H4R7MAA |
| A1C88 | 19599-004 | CAP ELCTLT RDL 4.7uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H4R7MAA |
| A1C89 | 20085-002 | CAP ELCTLT 4.7uF -10/+50% 250V | NICHICON (AMERICA) CORP. | UHU2E4R7TPA |
| A1C90 | 20608-001 | CAP MET PCARB 0.68MF 10% 100V | WIMA | MKC4-0.68-100-10 |
| A1C91 | 19600-001 | CAP ELCTLT RDL 100uF 20% 100V | NICHICON (AMERICA) CORP. | ULB2A101MRA |
| A1C92 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A1C93 | 15776-008 | CAP CER .047 MFD 10% 50V | CENTRALAB | CW20C473K |
| A1C94 | 15776-003 | CAP,CER .022 MFD 10% 50V | CENTRALAB | CW15C223K |
| A1C95 | 19601-001 | CAP POLYPRO .01MF 5% 600V | SPRAGUE ELECTRIC CO. | 715P10356JD3 |
| A1C96 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C97 | 20244-001 | CAP MET POLY 3.3MF 10% 250V | WIMA | MKS 4 |
| A1C98 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C99 | 19599-001 | CAP.ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A1C102 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C103 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A1C104 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A1C105 | 15776-003 | CAP,CER .022 MFD 10% 50V | CENTRALAB | CW15C223K |
| A1C106 | 20032-001 | CAP POLYPRO 0.47MF 160V 5% | WIMA | MKP-4 0.47/160/5 |
| A1C107 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C108 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A1C109 | 19599-002 | CAP ELCTLT RDL 100uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H101MPA |
| A1C110 | 19599-004 | CAP ELCTLT RDL 4.7uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H4R7MAA |
| A1C111 | 16258-004 | CAP METAL POLY .033uF 63V 10% | WIMA | MKS2-.033-63-10 |
| A1C112 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A1C113 | 10000-013 | CAP CER 330PF 20% 1000VDC | SPRAGUE ELECTRIC CO. | 50AT33 |
| A1C114 | 19600-001 | CAP ELCTLT RDL 100uF 20% 100V | NICHICON (AMERICA) CORP. | ULB2A101MRA |
| A1C115 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C116 | 19599-010 | CAP ELCTLT RDL 220uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H221MRA |
| A1C117 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A1C118 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A1C119 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C120 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C121 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A1C122 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C123 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C124 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C125 | 20241-001 | CAP ELCTLT RDL 1uF 20% 160V | UNITED CHEMICON CORPORATI | KMC160VB1R0M6X11LL |
| A1C126 | 20241-001 | CAP ELCTLT RDL 1uF 20% 160V | UNITED CHEMICON CORPORATI | KMC160VB1R0M6X11LL |
| A1C127 | 19599-005 | CAP ELCTLT RDL 3.3uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H3R3MAA |
| A1C128 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A1C129 | 15776-003 | CAP,CER .022 MFD 10% 50V | CENTRALAB | CW15C223K |
| A1CR1 | 20016 | RECTIFIER BRIDGE DIP 1A VM28 | VARO | VM28 |
| A1CR2 | 10044-001 | DIODE 1N4383 | DIODES INCORPORATED | J2 |
| A1CR3 | 19992 | DIODE 1N5819 | MOTOROLA (SPD) | 1N5819 |
| A1CR4 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A1CR5 | 20017 | RECTIFIER BRIDGE 10A VJ847 | VARO | VJ847 |
| A1CR6 | 20012 | DIODE PWR RECT MR826 | MOTOROLA (SPD) | MR826 |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A1CR7 | 20007 | SCR 25A RMS 2N6508 | MOTOROLA (SPD) | 2N6508 |
| A1CR8 | 20020 | DIODE ZENER 1N5242B | MOTOROLA (SPD) | 1N5242B |
| A1CR9 | 20014 | DIODE ZENER REG 1N5281B | MOTOROLA (SPD) | 1N5281B |
| A1CR10 | 20014 | DIODE ZENER REG 1N5281B | MOTOROLA (SPD) | 1N5281B |
| A1CR11 | 20012 | DIODE PWR RECT MR826 | MOTOROLA (SPD) | MR826 |
| A1CR12 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR13 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR14 | 20012 | DIODE PWR RECT MR826 | MOTOROLA (SPD) | MR826 |
| A1CR15 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR16 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR17 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR18 | 20015 | DIODE ZENER REG 5W 1N5383B | MOTOROLA (SPD) | 1N5383B |
| A1CR19 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A1CR20 | 19992 | DIODE 1N5819 | MOTOROLA (SPD) | 1N5819 |
| A1CR21 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A1CR22 | 20605 | DIODE ZENER IN5232B 5.6V | MOTOROLA (SPD) | IN5232B |
| A1CR24 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR25 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR26 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR27 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR28 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR29 | 20011 | DIODE SCH BARRIER MBR1545CT | MOTOROLA (SPD) | MBR1545CT |
| A1CR30 | 20022 | DIODE SCH BARRIER MBR1045 | MOTOROLA (SPD) | MBR1045 |
| A1CR31 | 20022 | DIODE SCH BARRIER MBR1045 | MOTOROLA (SPD) | MBR1045 |
| A1CR32 | 20021 | DIODE SCH BARRIER MBR2535CT | MOTOROLA (SPD) | MBR2535CT |
| A1CR33 | 20517 | RECTIFIER, SCHOTTKY POWER | MOTOROLA (SPD) | MBR040 |
| A1CR34 | 20517 | RECTIFIER, SCHOTTKY POWER | MOTOROLA (SPD) | MBR040 |
| A1CR35 | 20035 | IC VOLT REF 5V REG DIODE | NATIONAL SEMICONDUCTOR | LM336BZ-5.0 |
| A1CR36 | 10044-001 | DIODE 1N4383 | DIODES INCORPORATED | J2 |
| A1CR37 | 10044-001 | DIODE 1N4383 | DIODES INCORPORATED | J2 |
| A1CR39 | 19992 | DIODE 1N5819 | MOTOROLA (SPD) | 1N5819 |
| A1CR40 | 10044-001 | DIODE 1N4383 | DIODES INCORPORATED | J2 |
| A1CR41 | 10045 | DIODE 1N823 ZENER REF 6.2V 5% | SIEMENS | IN823 |
| A1CR42 | 20644 | DIODE FAST RECOVERY MR818 | MOTOROLA (SPD) | MR818 |
| A1CR43 | 10044-001 | DIODE 1N4383 | DIODES INCORPORATED | J2 |
| A1CR44 | 10044-001 | DIODE 1N4383 | DIODES INCORPORATED | J2 |
| A1CR45 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A1CR47 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR48 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A1CR49 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A1CR50 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A1CR51 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1CR52 | 20009 | DIODE FAST RECOVERY 1N4937 | MOTOROLA (SPD) | 1N4937 |
| A1J1 | 19183-004 | CONN HDR HSG MATE-N-LOK 4 POS | AMP, INC. | 350543-1 |
| A1J2 | 19182-004 | CONN HDR MALE PCB W/L 34 POS | 3M COMPANY | 3431-6202 |
| A1J3 | 19183-003 | CONN HDR HSG MATE-N-LOK 10POS | AMP, INC. | 1-380991-0 |
| A1J4 | 19183-001 | CONN HDR HSG MATE-N-LOK 6PINS | AMP, INC. | 1-380999-0 |
| A1J5 | 19183-005 | CONN HDR HSG MATE-N-LOK 8 POS | AMP, INC. | 350212-1 |
| A1J6 | 19183-002 | CONN HDR HSG MATE-N-LOK 2POS | AMP, INC. | 350539-1 |
| A1J7 | 19183-004 | CONN HDR HSG MATE-N-LOK 4 POS | AMP, INC. | 350543-1 |
| A1J8 | 19182-005 | CONN HDR MALE PCB W/LK 14POS | 3M COMPANY | 3314-6202 |
| A1J9 | 19477-003 | CONN HDR POST STR LOCK 4POS | AMP, INC. | 640456-4 |
| A1J10 | 19477-002 | CONN HDR POST STR LOCK 3 POS | AMP, INC. | 640456-3 |
| A1J11 | 14654 | TAB CONN. QUICK DISCONNECT | KEYSTONE MFG | 1287 |
| A1J12 | 14654 | TAB CONN. QUICK DISCONNECT | KEYSTONE MFG | 1287 |
| A1J13 | 14654 | TAB CONN. QUICK DISCONNECT | KEYSTONE MFG | 1287 |
| A1J14 | 14654 | TAB CONN. QUICK DISCONNECT | KEYSTONE MFG | 1287 |
| A1J15 | 14654 | TAB CONN. QUICK DISCONNECT | KEYSTONE MFG | 1287 |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A1L1 | 20098 | INDUCTOR ,5UH | WAVETEK MICROWAVE | PER WMI(A)20098 |
| A1L2 | 20097 | INDUCTOR ,3MH | WAVETEK MICROWAVE | PER WMI(A)20097 |
| A1L3 | 20099 | INDUCTOR ,18UH | WAVETEK MICROWAVE | PER WMI(A)20099 |
| A1L4 | 20099 | INDUCTOR ,18UH | WAVETEK MICROWAVE | PER WMI(A)20099 |
| A1L5 | 20100 | INDUCTOR,20 AMP 10UH | WAVETEK MICROWAVE | PER WMI(B)20100 |
| A1L6 | 20606-001 | COIL, FLAT-WDG 68 MH 10% | RENCO ELECTRONICS, INC. | RL-1160-68 |
| A1L7 | 20095 | COIL, HORIZONTAL LINEARITY | PREM MAGNETICS INC | PER WMI 20095 |
| A1L8 | 20094 | COIL , ADJ. HORIZ. WIDTH | WAVETEK MICROWAVE | PER WMI(A)20094 |
| A1L9 | 20609-001 | COIL MOLDED 430MH 5% | DALE ELECTRONICS, INC. | IM-4 430MH +-5% |
| A1L10 | 10631-015 | COIL, RF MLD 4.7uH 40% | DELEVAN | #1025-36 |
| A1L11 | 10631-023 | COIL, RF MLD 1.0uH 10% | DELEVAN | 1025-20 |
| A1Q1 | 20002 | TRANSISTOR PWR FET MTP2P50 | MOTOROLA (SPD) | MTP2P50 |
| A1Q2 | 20008 | TRANSISTOR NPN PWR MJE13071 | MOTOROLA (SPD) | MJE13071 |
| A1Q3 | 20005 | TRANSISTOR PWR FET IRF610 | MOTOROLA (SPD) | IRF610 |
| A1Q4 | 20004 | TRANSISTOR PWR FET MTP10N25 | MOTOROLA (SPD) | MTP10N25 |
| A1Q5 | 20004 | TRANSISTOR PWR FET MTP10N25 | MOTOROLA (SPD) | MTP10N25 |
| A1Q6 | 13904 | TRANSISTOR POWER TIP 30 | TEXAS INSTRUMENTS | TIP30 |
| A1Q7 | 10017 | TRANSISTOR 2N3569 | NATIONAL SEMICONDUCTOR | 0 |
| A1Q8 | 20003 | TRANSISTOR PWR MOSFET IRFZ30 | INTERNATIONAL RECTIFIER | IRFZ30 |
| A1Q9 | 20003 | TRANSISTOR PWR MOSFET IRFZ30 | INTERNATIONAL RECTIFIER | IRFZ30 |
| A1Q10 | 13534 | TRANSISTOR 2N2221/A | NATIONAL SEMICONDUCTOR | 02N2221 |
| A1Q11 | 20118 | TRANSISTOR, N-CHAN FET IRF840 | MOTOROLA (SPD) | IRF840 |
| A1Q12 | 10206 | TRANSISTOR 2N3053 | NATIONAL SEMICONDUCTOR | 2N3053 |
| A1Q13 | 20004 | TRANSISTOR PWR FET MTP10N25 | MOTOROLA (SPD) | MTP10N25 |
| A1R1 | 10013-058 | RES DEP CARB 560K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R2 | 10015-104 | RES MET FILM 5.62K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 5.62K OHM 1% |
| A1R3 | 10013-049 | RES DEP CARB 100K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R4 | 14941-010 | RES, CARB FILM, 56K, 5% 1W | TTI INC. | RC32GF 56K-J |
| A1R5 | 10013-032 | RES CARB FILM 3.9K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R6 | 10015-027 | RES MET FILM 56.2K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 56.2K OHM 1% |
| A1R7 | 10013-013 | RES DEP CARB 100 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R8 | 14941-010 | RES, CARB FILM, 56K, 5% 1W | TTI INC. | RC32GF 56K-J |
| A1R9 | 10241-003 | RES CARB COMP 4.7 OHM 5% 1/2W | MEPCO/ELECTRA | RC-1/2-4R7J |
| A1R10 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R11 | 10013-114 | RES DEP CARB 1.0 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R12 | 10013-001 | RES DEP CARB 10 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R13 | 16567-001 | RES CARB COMP 100HM 5% 2W | TTI INC. | HB1005 |
| A1R14 | 10015-049 | RES MET FILM 750 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 750 OHM 1% |
| A1R15 | 10015-080 | RES MET FILM 4.02K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 4.02K OHM 1% |
| A1R16 | 10013-006 | RES DEP CARB 27 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R17 | 10015-007 | RES MET FILM 10.0K OHM 1% 1/8W | LARTRONICS, INC. | 10.0K OHM 1% 1/8W |
| A1R18 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R19 | 12449-019 | RES MF 1.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A1R20 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R21 | 10015-096 | RES MET FILM 12.1K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 12.1K OHM 1% |
| A1R22 | 10015-031 | RES MET FILM 3.16K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 3.16K OHM 1% |
| A1R23 | 10013-045 | RES DEP CARB 47K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R24 | 10015-111 | RES MET FILM 24.9 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 24.9 OHM 1% 1/8W |
| A1R25 | 12449-019 | RES MF 1.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A1R26 | 10015-031 | RES MET FILM 3.16K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 3.16K OHM 1% |
| A1R27 | 10013-049 | RES DEP CARB 100K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R28 | 10013-001 | RES DEP CARB 10 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R29 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R30 | 10015-142 | RES MET FILM 40.2 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 40.2 OHM 1% 1/8W |
| A1R31 | 10015-013 | RES MET FILM 100K OHM 1 % 1/8W | CORNING GLASS WORKS | RN55D 100K OHM 1% |
| A1R32 | 10015-047 | RES MET FILM 2.49K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 2.49K OHM 1% |
| A1R33 | 10015-342 | RES MET FILM 154 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 154 OHM 1% |
| A1R34 | 10015-013 | RES MET FILM 100K OHM 1 % 1/8W | CORNING GLASS WORKS | RN55D 100K OHM 1% |
| A1R35 | 10015-047 | RES MET FILM 2.49K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 2.49K OHM 1% |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A1R36 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R37 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R38 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R39 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R40 | 10013-096 | RES DEP CARB 20K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R41 | 10015-207 | RES MET FILM 20.0K OHM 1% 1/8W | CORNING GLASS WORKS | 20K OHM 1% |
| A1R42 | 10015-105 | RES MET FILM 6.19K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 6.19K OHM 1% |
| A1R43 | 10015-207 | RES MET FILM 20.0K OHM 1% 1/8W | CORNING GLASS WORKS | 20K OHM 1% |
| A1R44 | 10015-062 | RES MET FILM 200K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 200K OHM 1% |
| A1R45 | 10015-105 | RES MET FILM 6.19K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 6.19K OHM 1% |
| A1R46 | 10015-062 | RES MET FILM 200K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 200K OHM 1% |
| A1R47 | 10015-061 | RES MET FILM 39.2K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 39.2K OHM 1% |
| A1R49 | 10013-013 | RES DEP CARB 100 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R51 | 10013-051 | RES DEP CARB 150K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R52 | 10013-051 | RES DEP CARB 150K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R54 | 10013-013 | RES DEP CARB 100 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R56 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R57 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R58 | 10013-003 | RES DEP CARB 15 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R60 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R61 | 10013-026 | RES CARB FILM 1.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R62 | 10015-190 | RES MET FILM 13.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 13K OHM 1% |
| A1R63 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R64 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A1R65 | 10013-017 | RES DEP CARB 220 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R66 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R67 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R68 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R69 | 10015-154 | RES MET FILM 806 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 806 OHM 1% |
| A1R70 | 10015-065 | RES MET FILM 4.99K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 4.99K OHM 1% |
| A1R71 | 12449-037 | RES MF 20.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A1R72 | 12449-021 | RES MF 10.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A1R73 | 10013-006 | RES DEP CARB 27 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R74 | 10015-145 | RES MET FILM 127 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 127 OHM 1% |
| A1R75 | 10015-020 | RES MET FILM 1.10K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1.10K OHM 1% |
| A1R76 | 10013-029 | RES DEP CARB 2.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R77 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R78 | 10015-154 | RES MET FILM 806 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 806 OHM 1% |
| A1R79 | 12449-021 | RES MF 10.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A1R80 | 12449-021 | RES MF 10.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A1R81 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R82 | 10013-006 | RES DEP CARB 27 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R83 | 10013-006 | RES DEP CARB 27 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R84 | 10013-029 | RES DEP CARB 2.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R85 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R87 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R88 | 13908-002 | RES WIREWOUND 39 OHM 5% 2W | TTI INC. | 0 |
| A1R89 | 13908-002 | RES WIREWOUND 39 OHM 5% 2W | TTI INC. | 0 |
| A1R90 | 10013-017 | RES DEP CARB 220 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R91 | 10013-017 | RES DEP CARB 220 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R92 | 10015-009 | RES MET FILM 17.8K OHM 1% 1/8W | LARTRONICS, INC. | RN55D 17.8K OHM 1% 1/8W |
| A1R93 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R94 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R95 | 10015-206 | RES MET FILM 7.50K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 7.50K OHM 1% |
| A1R96 | 10015-141 | RES MET FILM 316K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 3316K OHM 1% |
| A1R97 | 10013-080 | RES CARB FILM 2.4K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R98 | 10015-188 | RES MET FILM 33.2K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 33.2K OHM 1% |
| A1R99 | 10015-007 | RES MET FILM 10.0K OHM 1% 1/8W | LARTRONICS, INC. | 10.0K OHM 1% 1/8W |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A1R100 | 10015-310 | RES MF, 68.1 K, 1%, 1/4W @ 70 | CORNING GLASS WORKS | RB55D 68.1K OHM 1% |
| A1R101 | 10015-065 | RES MET FILM 4.99K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 4.99K OHM 1% |
| A1R103 | 20001-003 | RES VAR(1TTA) 10K OHM 20% 1/2W | MURATA/ERIE CORP | 3321H-1-103M |
| A1R104 | 10013-023 | RES DEP CARB 680 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R105 | 20000-007 | RES VAR(ITSA) 500 OHM 20% 1/2W | MURATA ERIE C/O | 3321N-1-501M |
| A1R106 | 10015-090 | RES MET FILM 24.9K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 24.9K OHM 1% |
| A1R107 | 10015-133 | RES MET FILM 49.9K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 49.9K OHM 1% |
| A1R108 | 10013-061 | RES DEP CARB 1M OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R109 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R110 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R111 | 10013-001 | RES DEP CARB 10 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R112 | 10013-039 | RES DEP CARB 15K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R113 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R114 | 10013-023 | RES DEP CARB 680 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R115 | 10013-049 | RES DEP CARB 100K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R116 | 10013-001 | RES DEP CARB 10 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R117 | 10013-041 | RES DEP CARB 22K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R118 | 10013-049 | RES DEP CARB 100K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R119 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R120 | 10015-195 | RES MET FILM 200 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 200 OHM 1% |
| A1R121 | 10015-032 | RES MET FILM 3.83K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 3.83K OHM 1% |
| A1R122 | 10015-221 | RES MET FILM 4.22K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 4.22K OHM 1% |
| A1R123 | 20000-006 | RES VAR (1TSA) 2K OHM 20% 1/2W | MURATA ERIE C/O | 3321N-1-202M |
| A1R124 | 10013-017 | RES DEP CARB 220 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R125 | 10013-017 | RES DEP CARB 220 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R126 | 10015-007 | RES MET FILM 10.0K OHM 1% 1/8W | LARTRONICS, INC. | 10.0K OHM 1% 1/8W |
| A1R128 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R129 | 10015-207 | RES MET FILM 20.0K OHM 1% 1/8W | CORNING GLASS WORKS | 20K OHM 1% |
| A1R130 | 10015-207 | RES MET FILM 20.0K OHM 1% 1/8W | CORNING GLASS WORKS | 20K OHM 1% |
| A1R131 | 10015-207 | RES MET FILM 20.0K OHM 1% 1/8W | CORNING GLASS WORKS | 20K OHM 1% |
| A1R132 | 10015-232 | RES MET FILM 432K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 432K OHM 1% |
| A1R134 | 10015-250 | RES MET FILM 60.4K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 60.4K OHM 1% |
| A1R135 | 10015-120 | RES MET FILM 69.8K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 69.8K OHM 1% |
| A1R136 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A1R137 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R138 | 10241-059 | RES CARB COMP 750 OHM 5% 1/2W | T.T.I. | RC200F750J |
| A1R139 | 10015-117 | RES MET FILM 54.9K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 54.9K OHM 1% |
| A1R140 | 10015-140 | RES MET FILM 499 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 499 OHM 1% |
| A1R141 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A1R142 | 10015-206 | RES MET FILM 7.50K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 7.50K OHM 1% |
| A1R143 | 10015-065 | RES MET FILM 4.99K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 4.99K OHM 1% |
| A1R144 | 10015-224 | RES MET FILM 150 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 150 OHM 1% |
| A1R145 | 20001-004 | RES VAR (ITTA) 50 OHM 20% 1/2W | MURATA/ERIE CORP | 3321H-1-500M |
| A1R146 | 10015-247 | RES MET FILM 22.1K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 22.1K OHM 1% |
| A1R147 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A1R149 | 20001-002 | RES VAR(1TTA) 1K OHM 20% 1/2W | MURATA/ERIE CORP | 3321H-1-102M |
| A1R150 | 10241-062 | RES CARB COMP 560 OHM 5% 1/2 W | LARTRONICS, INC. | RC200F 560 OHM-J |
| A1R151 | 10015-186 | RES MET FILM 10.0 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 10 OHM 1% |
| A1R152 | 14941-012 | RES CARB COMP 390 OHM 5% 1W | ALLEN-BRADLEY CO. | RCR320391J |
| A1R153 | 10015-186 | RES MET FILM 10.0 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 10 OHM 1% |
| A1R154 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R155 | 10013-021 | RES DEP CARB 470 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R156 | 10015-114 | RES MET FILM 75K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 75K OHM 1% |
| A1R157 | 10015-007 | RES MET FILM 10.0K OHM 1% 1/8W | LARTRONICS, INC. | 10.0K OHM 1% 1/8W |
| A1R158 | 10015-133 | RES MET FILM 49.9K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 49.9K OHM 1% |
| A1R159 | 10015-197 | RES MET FILM 221 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 221 OHM 1% |
| A1R160 | 10015-080 | RES MET FILM 4.02K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 4.02K OHM 1% |
| A1R161 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A1R162 | 19999-001 | RES WW PREC PWR .05 OHM 1% 3W | DALE ELECTRONICS, INC. | LVR-3 |
| A1R163 | 10015-029 | RES MET FILM 422 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 422 OHM 1% |
| A1R164 | 10015-013 | RES MET FILM 100K OHM 1 % 1/8W | CORNING GLASS WORKS | RN55D 100K OHM 1% |
| A1R165 | 10013-021 | RES DEP CARB 470 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R166 | 10013-067 | RES DEP CARB 3.3M OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R167 | 10013-067 | RES DEP CARB 3.3M OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R168 | 10013-021 | RES DEP CARB 470 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R169 | 10015-013 | RES MET FILM 100K OHM 1 % 1/8W | CORNING GLASS WORKS | RN55D 100K OHM 1% |
| A1R170 | 10015-029 | RES MET FILM 422 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 422 OHM 1% |
| A1R171 | 19999-001 | RES WW PREC PWR .05 OHM 1% 3W | DALE ELECTRONICS, INC. | LVR-3 |
| A1R172 | 10015-009 | RES MET FILM 17.8K OHM 1% 1/8W | LARTRONICS, INC. | RN55D 17.8K OHM 1% 1/8W |
| A1R175 | 10013-001 | RES DEP CARB 10 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R176 | 10241-034 | RES CARB COMP, 470 OHM 5% 1/2W | LARTRONICS, INC. | RC208F470J |
| A1R177 | 10015-242 | RES MET FILM 37.4K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 37.4K OHM 1% |
| A1R178 | 10015-226 | RES MET FILM 2.21K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 2.21K OHM 1% |
| A1R179 | 10015-345 | RES MET FILM 84.5K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 84.5K OHM 1% 1/8W |
| A1R181 | 10015-013 | RES MET FILM 100K OHM 1 % 1/8W | CORNING GLASS WORKS | RN55D 100K OHM 1% |
| A1R182 | 10015-140 | RES MET FILM 499 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 499 OHM 1% |
| A1R183 | 10015-006 | RES MET FILM 464K OHM 1% 1/8W | LARTRONICS, INC. | RN55D 464K OHM 1% 1/8W |
| A1R184 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R185 | 10013-049 | RES DEP CARB 100K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R186 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R187 | 10013-049 | RES DEP CARB 100K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R188 | 10015-207 | RES MET FILM 20.0K OHM 1% 1/8W | CORNING GLASS WORKS | 20K OHM 1% |
| A1R189 | 10013-027 | RES DEP CARB 1.5K OHM 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R190 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A1R191 | 10015-068 | RES MET FILM 100 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 100 OHM 1% |
| A1R192 | 10015-140 | RES MET FILM 499 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 499 OHM 1% |
| A1R193 | 10015-140 | RES MET FILM 499 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 499 OHM 1% |
| A1RT1 | 20523 | THERMISTOR DISC 10 OHM 5 AMPS | KEYSTONE CARBON CO. | CL-60 |
| A1RT2 | 15208-001 | THERMISTOR, PARALLEL 10K OHM | QUALITY THERMISTOR, INC. | QT-MC-14 |
| A1RT3 | 20607-001 | THMS,PTC 1.65 OHM @.17A(HOLD) | RAYCHEM CORPORATION | RXE 017 |
| A1RV1 | 20033 | VARISTOR MET OXIDE DISC 275V | GENERAL ELECTRIC CO. | V275LA40B |
| A1T1 | 20092 | TRANSFORMER , POWER 60HZ | SIGNAL TRANSFORMER | 14A.2.5-20 |
| A1T2 | 20090 | TRANSFORMER ,CURRENT SENSE | NANO PULSE INDUSTRIES | NP-4600 |
| A1T3 | 20089 | TRANSFORMER ,REGULATOR DRIVE | WAVETEK MICROWAVE | PER WMI(A)20089 |
| A1T4 | 20088 | TRANSFORMER , INVERTER DRIVE | WAVETEK MICROWAVE | PER WMI(A)20088 |
| A1T5 | 20093 | TRANSFORMER , POWER | MINI MAGNETICS, INC. | PER WMI 20093 |
| A1T6 | 20096 | COIL ,PINCUSHION | WAVETEK MICROWAVE | PER WMI(A)20096 |
| A1T7 | 20091 | TRANSFORMER , FLYBACK | WAVETEK MICROWAVE | PER WMI(A)20091 |
| A1TP1 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP2 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP3 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP4 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP5 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP6 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP7 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP8 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP9 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP10 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP11 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP12 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP13 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP14 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP15 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP16 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP17 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP18 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP19 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A1TP20 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP21 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP22 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP23 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP24 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP25 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP26 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP27 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP28 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP29 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP30 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP31 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP32 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP33 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1TP34 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A1U1 | 20026 | IC CURRENT MODE PWM CONTROLLER | UNITRODE | UC3846N |
| A1U2 | 20023 | IC PHASE-LOCK LOOP | MOTOROLA (SPD) | NE565N |
| A1U3 | 20025 | IC OFF LINE PWM CONTROLLER | UNITRODE | UC3842N |
| A1U4 | 19490 | INTEGRATED CKT MC34074 | MOTOROLA (SPD) | MC34074P |
| A1U5 | 19490 | INTEGRATED CKT MC34074 | MOTOROLA (SPD) | MC34074P |
| A1U6 | 20028 | IC DUAL O/U VOLT DETECTOR | MAXIM TECHNOLIGIES | ICL7665ACPA |
| A1U7 | 20028 | IC DUAL O/U VOLT DETECTOR | MAXIM TECHNOLIGIES | ICL7665ACPA |
| A1U8 | 20030 | IC BIPOLAR ANALOG | NEC | uPC1378H |
| A1U9 | 14621 | INTEGRATED CKT LM358N | NATIONAL SEMICONDUCTOR | LM358N |
| A1U10 | 20029 | IC HORIZ/VERT DEFLECT CKT | NEC | uPC1377C |
| A1U11 | 20083 | IC 3-TERM POS VOLT REG | NATIONAL SEMICONDUCTOR | LM350T |
| A1U12 | 20027 | IC 3-TERM NEG VOLT REG | MOTOROLA (SPD) | MC7912CT |
| A1U13 | 13479-002 | IC-3TERM ADJUSTABLE REGULATOR | NATIONAL SEMICONDUCTOR | LM317T |
| A1U14 | 20031 | IC H.V. ADJ REGULATOR | TEXAS INSTRUMENTS | TL783C |
| A1U15 | 20555 | IC +12V OUTPUT VOLT REG | MOTOROLA (SPD) | MC78L12ACP |
| A1W1 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A1W2 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A1W3 | 20119-001 | JUMPER, INSULATED .500 LEAD SP | MC KENZIE TECHNOLOGY | JO .500 X 0.125-PVC-24 |
| A1W4 | 20119-001 | JUMPER, INSULATED .500 LEAD SP | MC KENZIE TECHNOLOGY | JO .500 X 0.125-PVC-24 |
| A1W5 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A1W6 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A1W7 | 20119-001 | JUMPER, INSULATED .500 LEAD SP | MC KENZIE TECHNOLOGY | JO .500 X 0.125-PVC-24 |
| A1W8 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A1W10 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A1W11 | 20642-001 | CBL ASSY, 12 GA JMPR 11.00IN. | WAVETEK MICROWAVE | PER WMI 20642-001 |
| A1XQ11 | 20063 | HEATSINK CLIP-ON TO-220 | THERMALLOY | 6043PB |

## CRT CATHODE PC BOARD ASSEMBLY #19167

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A2C1 | 19600-005 | CAP ELCTLT RDL 1.0uF 20% 100V | NICHICON (AMERICA) CORP. | ULB2A010MAA |
| A2C2 | 19600-004 | CAP ELCTLT RDL 4.7uF 20% 100V | NICHICON (AMERICA) CORP. | ULB2A4R7MAA |
| A2C3 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A2C4 | 19600-003 | CAP ELCTLT RDL 10uF 20% 100V | NICHICON (AMERICA) CORP. | ULB2A100MAA |
| A2C5 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A2C6 | 15776-018 | CAP, Ceramic,4700pF X7R, 50V | CENTRALAB | CW15C472K |
| A2C7 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A2C8 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A2C9 | 15776-018 | CAP, Ceramic,4700pF X7R, 50V | CENTRALAB | CW15C472K |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A2C10 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A2C11 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A2C12 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A2C13 | 15776-018 | CAP, Ceramic,4700pF X7R, 50V | CENTRALAB | CW15C472K |
| A2C14 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A2C15 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A2C16 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A2C17 | 10677-002 | CAP MICA 220PF 5% 500WVDC | ARCO | DM15F221J500V |
| A2C18 | 10677-002 | CAP MICA 220PF 5% 500WVDC | ARCO | DM15F221J500V |
| A2C19 | 10677-002 | CAP MICA 220PF 5% 500WVDC | ARCO | DM15F221J500V |
| A2C20 | 14116-003 | CAP CERAMIC .005MF 20% 3KV | CENTRALAB | DD30-502 |
| A2C21 | 20241-003 | CAP ELCTLT RDL 4.7uF 20% 160V | NICHICON (AMERICA) CORP. | UHU2C4R7MPA |
| A2C22 | 10909-010 | CAP MICA 1000PF 1% 500V | ARCO | CM06FD102F03 |
| A2C23 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A2C24 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A2C25 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A2C26 | 16258-001 | CAP MET MYLAR 1.0MFD 50V 10% | WIMA | MKS\1.0UF\10% |
| A2C27 | 16258-001 | CAP MET MYLAR 1.0MFD 50V 10% | WIMA | MKS\1.0UF\10% |
| A2CR1 | 20116 | DIODE, ZENER 1N5262A | MOTOROLA (SPD) | 1N5262A |
| A2CR2 | 10044-001 | DIODE 1N4383 | DIODES INCORPORATED | J2 |
| A2CR3 | 20240 | DIODE, ZENER 1N5273B 120V | MOTOROLA (SPD) | 1N5273B |
| A2J1 | 19182-005 | CONN HDR MALE PCB W/LK 14POS | 3M COMPANY | 3314-6202 |
| A2J2 | 19182-005 | CONN HDR MALE PCB W/LK 14POS | 3M COMPANY | 3314-6202 |
| A2J3 | 19477-010 | CONN HDR POST STR LOCK 7 POS | AMP, INC. | 640456-7 |
| A2J4 | 19477-004 | CONN HDR POST STR LOCK 6 POS | AMP, INC. | 640456-6 |
| A2J5 | 19477-001 | CONN HDR POST STR LOCK 2POS | AMP, INC. | 640456-2 |
| A2L1 | 10631-022 | COIL, RF MLD 2.2uH 10% | DELEVAN | 10025-28 |
| A2L2 | 10631-022 | COIL, RF MLD 2.2uH 10% | DELEVAN | 10025-28 |
| A2L3 | 10631-022 | COIL, RF MLD 2.2uH 10% | DELEVAN | 10025-28 |
| A2Q1 | 20056 | TRANSISTOR, 2N3019 | MOTOROLA (SPD) | 2N3019 |
| A2Q2 | 20056 | TRANSISTOR, 2N3019 | MOTOROLA (SPD) | 2N3019 |
| A2Q3 | 20056 | TRANSISTOR, 2N3019 | MOTOROLA (SPD) | 2N3019 |
| A2Q4 | 20058 | TRANSISTOR, 2N4957 | MOTOROLA (SPD) | 2N4957 |
| A2Q5 | 20057 | TRANSISTOR, 2N2369A | MOTOROLA (SPD) | 2N2369A |
| A2Q6 | 20058 | TRANSISTOR, 2N4957 | MOTOROLA (SPD) | 2N4957 |
| A2Q7 | 20057 | TRANSISTOR, 2N2369A | MOTOROLA (SPD) | 2N2369A |
| A2Q8 | 20058 | TRANSISTOR, 2N4957 | MOTOROLA (SPD) | 2N4957 |
| A2Q9 | 20057 | TRANSISTOR, 2N2369A | MOTOROLA (SPD) | 2N2369A |
| A2Q10 | 19023 | TRANS, GEN PUR, PNP, TO-92 | MOTOROLA (SPD) | 2N5401 |
| A2R1 | 10013-115 | RES DEP CARB 2 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FXXXJ |
| A2R2 | 10015-159 | RES MET FILM 402 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 402 OHM 1% |
| A2R3 | 10015-015 | RES MET FILM 21.5K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 21.5K OHM 1% |
| A2R4 | 10013-096 | RES DEP CARB 20K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R5 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R6 | 20619-001 | RES PWR FILM 510 OHM 1% 8W | CADDOCK ELECTRONICS, INC. | MS 281-510-1% |
| A2R7 | 10013-107 | RES DEP CARB 75 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FXXXJ |
| A2R8 | 10013-107 | RES DEP CARB 75 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FXXXJ |
| A2R9 | 20619-001 | RES PWR FILM 510 OHM 1% 8W | CADDOCK ELECTRONICS, INC. | MS 281-510-1% |
| A2R10 | 10013-107 | RES DEP CARB 75 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FXXXJ |
| A2R11 | 10013-107 | RES DEP CARB 75 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FXXXJ |
| A2R12 | 20619-001 | RES PWR FILM 510 OHM 1% 8W | CADDOCK ELECTRONICS, INC. | MS 281-510-1% |
| A2R13 | 10013-107 | RES DEP CARB 75 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FXXXJ |
| A2R14 | 10013-107 | RES DEP CARB 75 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FXXXJ |
| A2R15 | 10013-086 | RES CARB FILM 51 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R16 | 10015-197 | RES MET FILM 221 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 221 OHM 1% |
| A2R17 | 10015-149 | RES MET FILM 16.9 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 16.9 OHM 1% |
| A2R18 | 20000-005 | RES VAR (1TSA) 50 OHM 20% 1/2W | MURATA ERIE C/O | 3321N-1-500M |
| A2R19 | 10013-009 | RES DEP CARB 47 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A2R20 | 10013-005 | RES DEP CARB 22 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R21 | 10015-343 | RES MET FILM 17.8 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 17.8 OHM 1% |
| A2R22 | 10015-127 | RES MET FILM 36.5 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 36.5 OHM 1% 1/8W |
| A2R23 | 10015-144 | RES MET FILM 95.3 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 95.3 OHM 1% |
| A2R24 | 20000-007 | RES VAR(ITSA) 500 OHM 20% 1/2W | MURATA ERIE C/O | 3321N-1-501M |
| A2R25 | 10015-149 | RES MET FILM 16.9 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 16.9 OHM 1% |
| A2R26 | 20000-005 | RES VAR (1TSA) 50 OHM 20% 1/2W | MURATA ERIE C/O | 3321N-1-500M |
| A2R27 | 10013-009 | RES DEP CARB 47 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R28 | 10013-086 | RES CARB FILM 51 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R29 | 10015-197 | RES MET FILM 221 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 221 OHM 1% |
| A2R30 | 10013-005 | RES DEP CARB 22 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R31 | 10015-343 | RES MET FILM 17.8 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 17.8 OHM 1% |
| A2R32 | 10015-127 | RES MET FILM 36.5 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 36.5 OHM 1% 1/8W |
| A2R33 | 10015-144 | RES MET FILM 95.3 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 95.3 OHM 1% |
| A2R34 | 20000-007 | RES VAR(ITSA) 500 OHM 20% 1/2W | MURATA ERIE C/O | 3321N-1-501M |
| A2R35 | 10015-149 | RES MET FILM 16.9 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 16.9 OHM 1% |
| A2R36 | 20000-005 | RES VAR (1TSA) 50 OHM 20% 1/2W | MURATA ERIE C/O | 3321N-1-500M |
| A2R37 | 10013-009 | RES DEP CARB 47 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R38 | 10013-086 | RES CARB FILM 51 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R39 | 10015-197 | RES MET FILM 221 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 221 OHM 1% |
| A2R40 | 10013-005 | RES DEP CARB 22 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R41 | 10015-343 | RES MET FILM 17.8 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 17.8 OHM 1% |
| A2R42 | 10015-127 | RES MET FILM 36.5 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 36.5 OHM 1% 1/8W |
| A2R43 | 10015-144 | RES MET FILM 95.3 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 95.3 OHM 1% |
| A2R44 | 20000-007 | RES VAR(ITSA) 500 OHM 20% 1/2W | MURATA ERIE C/O | 3321N-1-501M |
| A2R45 | 10241-017 | RES CARB COMP 100K OHM 5% 1/2W | TTI INC. | RC20GF104J |
| A2R46 | 20061-001 | RES VAR (SPECIAL) 55M OHM 1/2W | SONY MFG CO OF AMERICA | 1-230-798-21 |
| A2R47 | 10015-065 | RES MET FILM 4.99K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 4.99K OHM 1% |
| A2R48 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R49 | 10013-013 | RES DEP CARB 100 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R50 | 10015-013 | RES MET FILM 100K OHM 1 % 1/8W | CORNING GLASS WORKS | RN55D 100K OHM 1% |
| A2R51 | 10013-045 | RES DEP CARB 47K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R52 | 10013-018 | RES DEP CARB 270 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R53 | 10013-061 | RES DEP CARB 1M OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R54 | 10013-018 | RES DEP CARB 270 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R56 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R57 | 10013-104 | RES CARB FILM 24K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A2R58 | 10015-188 | RES MET FILM 33.2K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 33.2K OHM 1% |
| A2TP1 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A2TP2 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A2TP3 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A2TP4 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A2TP5 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A2TP6 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A2TP7 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A2TP8 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A2TP9 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A2TP10 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A2U1 | 20031 | IC H.V. ADJ REGULATOR | TEXAS INSTRUMENTS | TL783C |
| A2U2 | 20618 | IC 3-TERM NEG VOLTAGE REG | MOTOROLA (SPD) | MC79M05CT |
| A2VR1 | 20239-001 | SRG VOLTAGE PROT (SVP) 90V 20% | SIEMENS | B1-C90/20 |
| A2VR2 | 20239-001 | SRG VOLTAGE PROT (SVP) 90V 20% | SIEMENS | B1-C90/20 |
| A2VR3 | 20239-001 | SRG VOLTAGE PROT (SVP) 90V 20% | SIEMENS | B1-C90/20 |
| A2VR4 | 20239-002 | SRG VOLTAGE PROT (SVP) 230V | SIEMENS | B1-A230 |
| A2XQ1 | 11037 | SPACER, NYLON TO-5 | ARROW ELECTRONICS | THERMALLOY 7717-22-N |
| A2XQ2 | 11037 | SPACER, NYLON TO-5 | ARROW ELECTRONICS | THERMALLOY 7717-22-N |
| A2XQ3 | 11037 | SPACER, NYLON TO-5 | ARROW ELECTRONICS | THERMALLOY 7717-22-N |
| A2XU1 | 20062 | HEATSINK, CLIP-ON TO-220 | THERMALLOY | 62398-MT |

# FRONT PANEL PC BOARD ASSEMBLY #17228

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A3C1 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A3C2 | 19598-010 | CAP ELCTLT RDL 33uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E330MAA |
| A3CR1 | 17206-001 | LED, ULTRA-BRIGHT YELLOW | HEWLETT PACKARD | HLMP-1440 |
| A3CR2 | 17206-001 | LED, ULTRA-BRIGHT YELLOW | HEWLETT PACKARD | HLMP-1440 |
| A3CR3 | 17206-001 | LED, ULTRA-BRIGHT YELLOW | HEWLETT PACKARD | HLMP-1440 |
| A3CR4 | 17206-001 | LED, ULTRA-BRIGHT YELLOW | HEWLETT PACKARD | HLMP-1440 |
| A3J1 | 19182-004 | CONN HDR MALE PCB W/L 34 POS | 3M COMPANY | 3431-6202 |
| A3Q1 | 10018 | TRANSISTOR 2N3646 | FAIRCHILD | 2N3646 |
| A3Q2 | 10018 | TRANSISTOR 2N3646 | FAIRCHILD | 2N3646 |
| A3Q3 | 10018 | TRANSISTOR 2N3646 | FAIRCHILD | 2N3646 |
| A3Q4 | 10018 | TRANSISTOR 2N3646 | FAIRCHILD | 2N3646 |
| A3R1 | 10013-014 | RES DEP CARB 120 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A3R2 | 10013-006 | RES DEP CARB 27 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A3R3 | 10013-029 | RES DEP CARB 2.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A3R4 | 10013-005 | RES DEP CARB 22 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A3R5 | 19500-001 | POT PNL/PCB 500 OHM 20% 1/2W | ALLEN-BRADLEY CO. | WP2002AS501MZ |
| A3R6 | 10013-029 | RES DEP CARB 2.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A3R7 | 10013-014 | RES DEP CARB 120 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A3R8 | 10013-029 | RES DEP CARB 2.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A3R9 | 10013-014 | RES DEP CARB 120 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A3R10 | 10013-029 | RES DEP CARB 2.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A3R11 | 10013-014 | RES DEP CARB 120 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A3R12 | 10013-023 | RES DEP CARB 680 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A3S1 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S2 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S3 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S4 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S5 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S6 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S7 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S8 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S9 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S10 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S11 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S12 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S14 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S15 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S17 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S19 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S20 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S21 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S22 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S23 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S24 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S25 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S26 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S27 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S28 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S29 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S30 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S31 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S32 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S33 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S34 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S35 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A3S36 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S37 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S38 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S39 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S40 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S41 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S42 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S43 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S44 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3S45 | 19978 | SWITCH PB SPST MOM N.O. PC MTG | CENTRALAB | K40111AA |
| A3U1 | 13470-044 | INTEGRATED CKT SN74LS138N | TEXAS INSTRUMENTS | SN74LS138N |

## ANALOG INTERCONNECT PC BOARD ASSEMBLY #17231

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A4C1 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A4C2 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A4C3 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A4C4 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A4C5 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A4C6 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A4C7 | 11501-008 | CAP CER .01UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U103M50V |
| A4C8 | 19598-001 | CAP ELCTLT RDL 470uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E471MRA |
| A4C9 | 19598-001 | CAP ELCTLT RDL 470uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E471MRA |
| A4C10 | 19598-001 | CAP ELCTLT RDL 470uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E471MRA |
| A4C11 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A4C12 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A4C13 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A4J1 | 19948-001 | CONN HDR .025POST .10SP 15POS | AMP, INC. | 1-103021-5 |
| A4J2 | 19948-001 | CONN HDR .025POST .10SP 15POS | AMP, INC. | 1-103021-5 |
| A4J3 | 19948-001 | CONN HDR .025POST .10SP 15POS | AMP, INC. | 1-103021-5 |
| A4J4 | 19948-001 | CONN HDR .025POST .10SP 15POS | AMP, INC. | 1-103021-5 |
| A4J5 | 19948-001 | CONN HDR .025POST .10SP 15POS | AMP, INC. | 1-103021-5 |
| A4J6 | 19948-001 | CONN HDR .025POST .10SP 15POS | AMP, INC. | 1-103021-5 |
| A4J7 | 19501-002 | CONN DIN FEM STR C(AC) 64POS | PANDUIT | 100-064-453 |
| A4J8 | 19501-002 | CONN DIN FEM STR C(AC) 64POS | PANDUIT | 100-064-453 |
| A4J9 | 19501-002 | CONN DIN FEM STR C(AC) 64POS | PANDUIT | 100-064-453 |
| A4J10 | 19501-002 | CONN DIN FEM STR C(AC) 64POS | PANDUIT | 100-064-453 |
| A4J11 | 19182-001 | CONN HDR MALE PCB W/LK 64 POS | 3M COMPANY | 3764-6202 |
| A4J12 | 19183-005 | CONN HDR HSG MATE-N-LOK 8 POS | AMP, INC. | 350212-1 |
| A4J13 | 19477-003 | CONN HDR POST STR LOCK 4POS | AMP, INC. | 640456-4 |
| A4J14 | 19182-004 | CONN HDR MALE PCB W/L 34 POS | 3M COMPANY | 3431-6202 |
| A4R1 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A4R2 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A4R3 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC07ZFxxxJ |
| A4R4 | 10013-018 | RES DEP CARB 270 OHM 5% 1/4W | MEPCO/ELECTRA | RC07ZFxxxJ |
| A4RP1 | 15098-010 | RES SIP(8X7R) 100K OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108A104 |
| A4U1 | 13470-044 | INTEGRATED CKT SN74LS138N | TEXAS INSTRUMENTS | SN74LS138N |
| A4XU1 | 10978-002 | IC SOCKET, 16 PIN | AMP, INC. | 583529-1 |

# CALIBRATOR PC BOARD ASSEMBLY #17169

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A5A1 | 20112 | CALIB THERM OVEN PCB ASSY | WAVETEK MICROWAVE | 20112 |
| A5C2 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C3 | 11501-008 | CAP CER .01UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U103M50V |
| A5C4 | 15776-010 | CAP, CER .22UF 10% 50V | CENTRALAB | CW30C224K |
| A5C6 | 20032-001 | CAP POLYPRO 0.47MF 160V 5% | WIMA | MKP-4 0.47/160/5 |
| A5C7 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A5C8 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C9 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A5C10 | 15640-010 | CAP CER USTBLE 33PF 10% 100V | MURATA/ERIE CORP | RPE110C0330K100V |
| A5C11 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C16 | 10909-011 | CAP. SILVER MICA 62 PF | ARCO | CM05FD620F03 |
| A5C17 | 10909-012 | CAP MICA 120PF 1% 500V | ARCO | CM06FD121J03 |
| A5C18 | 10909-011 | CAP. SILVER MICA 62 PF | ARCO | CM05FD620F03 |
| A5C19 | 10909-013 | CAP MICA 150PF 1% 500V | ARCO | DM15-151F |
| A5C20 | 10909-018 | CAP, SLVR MICA 240pF 1% 500V | ARCO | DM15-241F |
| A5C21 | 10677-018 | CAP MICA 1000PF 5% 500V | ARCO | DM15102J100V |
| A5C22 | 11501-008 | CAP CER .01UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U103M50V |
| A5C23 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C25 | 10677-018 | CAP MICA 1000PF 5% 500V | ARCO | DM15102J100V |
| A5C26 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C27 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C28 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C29 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C30 | 15776-008 | CAP CER .047 MFD 10% 50V | CENTRALAB | CW20C473K |
| A5C31 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C32 | 11501-008 | CAP CER .01UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U103M50V |
| A5C35 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A5C36 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A5C39 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C40 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C41 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C42 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C43 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C44 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C45 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C46 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C47 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C48 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C49 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C50 | 19599-004 | CAP ELCTLT RDL 4.7uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H4R7MAA |
| A5C51 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C52 | 19599-004 | CAP ELCTLT RDL 4.7uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H4R7MAA |
| A5C53 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C54 | 19599-004 | CAP ELCTLT RDL 4.7uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H4R7MAA |
| A5C55 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C56 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C57 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C58 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C60 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A5C61 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A5C62 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A5C63 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A5C64 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A5C66 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C67 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C68 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C69 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C70 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C71 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C72 | 15640-001 | CAP CER USTBLE 100PF 10% 100V | SPRAGUE ELECTRIC CO. | 1CC0G101X9100C4 |
| A5C73 | 15640-001 | CAP CER USTBLE 100PF 10% 100V | SPRAGUE ELECTRIC CO. | 1CC0G101X9100C4 |
| A5C74 | 15640-001 | CAP CER USTBLE 100PF 10% 100V | SPRAGUE ELECTRIC CO. | 1CC0G101X9100C4 |
| A5C75 | 15640-001 | CAP CER USTBLE 100PF 10% 100V | SPRAGUE ELECTRIC CO. | 1CC0G101X9100C4 |
| A5C76 | 15640-001 | CAP CER USTBLE 100PF 10% 100V | SPRAGUE ELECTRIC CO. | 1CC0G101X9100C4 |
| A5C77 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C78 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C79 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A5C80 | 11501-008 | CAP CER .01UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U103M50V |
| A5C81 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A5C82 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A5C83 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A5C84 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A5C85 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A5C86 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A5C87 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A5C88 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C89 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C90 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C91 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C92 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C93 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C94 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C95 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A5C96 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A5C97 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C98 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A5C100 | 15776-010 | CAP, CER .22UF 10% 50V | CENTRALAB | CN30C224K |
| A5C101 | 19598-002 | CAP ELCTLT RDL 47uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E470MAA |
| A5C102 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A5CR1 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A5CR2 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A5CR8 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A5CR10 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A5CR11 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A5CR12 | 13618 | DIODE,uWAVE PIN SW,.3PF,100ns | SDI | PER WMI DWG (C) 13618 |
| A5CR13 | 13618 | DIODE,uWAVE PIN SW,.3PF,100ns | SDI | PER WMI DWG (C) 13618 |
| A5CR14 | 13618 | DIODE,uWAVE PIN SW,.3PF,100ns | SDI | PER WMI DWG (C) 13618 |
| A5CR15 | 13618 | DIODE,uWAVE PIN SW,.3PF,100ns | SDI | PER WMI DWG (C) 13618 |
| A5CR16 | 13618 | DIODE,uWAVE PIN SW,.3PF,100ns | SDI | PER WMI DWG (C) 13618 |
| A5CR17 | 13618 | DIODE,uWAVE PIN SW,.3PF,100ns | SDI | PER WMI DWG (C) 13618 |
| A5CR18 | 13618 | DIODE,uWAVE PIN SW,.3PF,100ns | SDI | PER WMI DWG (C) 13618 |
| A5CR19 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A5CR20 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A5CR21 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A5J1 | 13271 | COUPLING STRAIGHT JACK | CABLEWAVE | 700209 |
| A5L1 | 10631-010 | COIL, RF MLD 6.8uH 10% | DELEVAN | 1025-40 |
| A5L2 | 15293 | COIL, RF .17uH | ZAMBRE CO | PER WPMI DWG |
| A5L3 | 15293 | COIL, RF .17uH | ZAMBRE CO | PER WPMI DWG |
| A5L4 | 19203 | RF COIL 0.1uH | ZAMBRE CO | WMI 19203 |
| A5L5 | 10631-010 | COIL, RF MLD 6.8uH 10% | DELEVAN | 1025-40 |
| A5L6 | 10631-010 | COIL, RF MLD 6.8uH 10% | DELEVAN | 1025-40 |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A5L7 | 10631-010 | COIL, RF MLD 6.8uH 10% | DELEVAN | 1025-40 |
| A5L9 | 15293 | COIL, RF .17uH | ZAMBRE CO | PER WPMI DWG |
| A5P1 | 19181-001 | CONN DIN MALE C ANG(AC)64 POS | PANDUIT | 100-964-053 |
| A5Q1 | 20242 | TRANSISTOR, NPN 2N3553 | TEXAS INSTRUMENTS | 2N3553 |
| A5Q2 | 10023 | TRANSISTOR 2N3644 | NATIONAL SEMICONDUCTOR | 3644 |
| A5Q3 | 10017 | TRANSISTOR 2N3569 | NATIONAL SEMICONDUCTOR | 0 |
| A5Q4 | 14623 | TRANSISTOR PNP 2N6489 | RCA | 2N6489 |
| A5Q5 | 10017 | TRANSISTOR 2N3569 | NATIONAL SEMICONDUCTOR | 0 |
| A5Q6 | 10017 | TRANSISTOR 2N3569 | NATIONAL SEMICONDUCTOR | 0 |
| A5R1 | 12449-048 | RES MF 15.00K OHM 0.1% 1/8W | DALE ELECTRONICS | MFF 1/8 T2 |
| A5R2 | 12449-032 | RES MF 1.250K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A5R3 | 10015-064 | RES MET FILM 1.13K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1.13K OHM 1% |
| A5R4 | 10015-014 | RES MET FILM 31.6K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 31.6K OHM 1% |
| A5R5 | 10015-098 | RES MET FILM 13.3K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 13.3K OHM 1% |
| A5R6 | 10013-034 | RES CARB FILM 5.6K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R8 | 10015-247 | RES MET FILM 22.1K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 22.1K OHM 1% |
| A5R17 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R18 | 10013-061 | RES DEP CARB 1M OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R19 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R22 | 12449-028 | RES MF 12.5K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A5R23 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R24 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R25 | 10013-057 | RES DEP CARB 470K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R26 | 10013-039 | RES DEP CARB 15K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R27 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A5R28 | 10015-046 | RES MET FILM 249 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 249 OHM 1% |
| A5R29 | 10015-074 | RES MET FILM 2.0K OHM 1% 1.8W | LARTRONICS, INC. | RN55D 2.0K OHM 1% 1/8W |
| A5R33 | 10013-027 | RES DEP CARB 1.5K OHM 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R34 | 10013-031 | RES DEP CARB 3.3K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R35 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R44 | 10015-007 | RES MET FILM 10.0K OHM 1% 1/8W | LARTRONICS, INC. | 10.0K OHM 1% 1/8W |
| A5R45 | 10013-006 | RES DEP CARB 27 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R46 | 10015-096 | RES MET FILM 12.1K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 12.1K OHM 1% |
| A5R47 | 10015-047 | RES MET FILM 2.49K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 2.49K OHM 1% |
| A5R48 | 10015-112 | RES MET FILM 374 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 374K OHM 1% |
| A5R49 | 10013-001 | RES DEP CARB 10 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R50 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R51 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R52 | 10013-041 | RES DEP CARB 22K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R53 | 10013-041 | RES DEP CARB 22K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R54 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R55 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R56 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R57 | 10013-045 | RES DEP CARB 47K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R58 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R59 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R60 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R61 | 10013-006 | RES DEP CARB 27 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R63 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R64 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R65 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R66 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R67 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R70 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R71 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R72 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R73 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R74 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R75 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A5R76 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R77 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R78 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R79 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R80 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R81 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R83 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R84 | 10013-029 | RES DEP CARB 2.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R85 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R86 | 10013-015 | RES DEP CARB 150 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R87 | 10013-017 | RES DEP CARB 220 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R88 | 10015-112 | RES MET FILM 374 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 374K OHM 1% |
| A5R89 | 10015-007 | RES MET FILM 10.0K OHM 1% 1/8W | LARTRONICS, INC. | 10.0K OHM 1% 1/8W |
| A5R90 | 10015-047 | RES MET FILM 2.49K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 2.49K OHM 1% |
| A5R91 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R92 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R93 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R94 | 10013-045 | RES DEP CARB 47K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R95 | 10013-029 | RES DEP CARB 2.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R96 | 10013-013 | RES DEP CARB 100 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R97 | 10013-029 | RES DEP CARB 2.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R98 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A5R99 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A5R100 | 10015-256 | RES MET FILM 1.5K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1.5K OHM 1% |
| A5R101 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A5R102 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A5R103 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A5R104 | 10015-140 | RES MET FILM 499 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 499 OHM 1% |
| A5R105 | 10015-140 | RES MET FILM 499 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 499 OHM 1% |
| A5R106 | 10015-082 | RES MET FILM 61.9 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 61.9K OHM 1% |
| A5R107 | 10015-144 | RES MET FILM 95.3 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 95.3 OHM 1% |
| A5R108 | 10015-144 | RES MET FILM 95.3 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 95.3 OHM 1% |
| A5R109 | 10015-122 | RES MET FILM 11.0 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 11 OHM 1% |
| A5R110 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A5R111 | 10015-140 | RES MET FILM 499 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 499 OHM 1% |
| A5R112 | 10015-140 | RES MET FILM 499 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 499 OHM 1% |
| A5R113 | 10015-200 | RES MET FILM 243 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 243 OHM 1% |
| A5R114 | 10015-082 | RES MET FILM 61.9 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 61.9K OHM 1% |
| A5R115 | 10015-082 | RES MET FILM 61.9 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 61.9K OHM 1% |
| A5R116 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R117 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A5R118 | 10015-125 | RES MET FILM 28.7 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 28.7 OHM 1% 1/8W |
| A5R119 | 12449-129 | RES MF 40.00K OHM 0.1% 1/8W | PRECISION RESISTIVE PRODU | GP1/4T10040.00K0.1% |
| A5R120 | 12449-128 | RES MF 13.33K OHM 0.1% 1/8W | PRECISION RESISTIVE PRODU | GP1/4T10013.33K0.1% |
| A5R121 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R122 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R123 | 12449-090 | RES MF 8.000K OHM 0.1% 1/8W | PRECISION RESISTIVE PRODU | GP 1/4 TC50 |
| A5R124 | 10015-065 | RES MET FILM 4.99K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 4.99K OHM 1% |
| A5R125 | 10015-116 | RES MET FILM 30.1K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 30.1K OHM 1% |
| A5R126 | 10015-054 | RES MET FILM 110K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 110K OHM 1% |
| A5R127 | 10013-030 | RES DEP CARB 2.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R128 | 11845-004 | RES MTL GLAZE 15 OHM 10% 2W | CORNING GLASS WORKS | FP-2 |
| A5R129 | 10013-078 | RES DEP CARB 2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R130 | 10013-078 | RES DEP CARB 2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R131 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R132 | 10013-027 | RES DEP CARB 1.5K OHM 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R133 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A5R134 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A5RP5 | 14881-009 | RES SIP(8X4R) 100 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108B101 |
| A5RP6 | 14881-009 | RES SIP(8X4R) 100 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108B101 |
| A5RT2 | 15208-001 | THERMISTOR, PARALLEL 10K OHM | QUALITY THERMISTOR, INC. | QT-MC-14 |
| A5RT3 | 20607-002 | THMS, PTC 0.75 OHM 0.5A(HOLD) | RAYCHEM CORPORATION | RXE050 |
| A5TP1 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A5TP2 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A5TP3 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A5TP4 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A5TP5 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A5TP6 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A5U1 | 15135 | INTEGRATED CKT HA7-5135-5 | PRECISION MONOLITHICS | OP-07/CP |
| A5U2 | 15135 | INTEGRATED CKT HA7-5135-5 | PRECISION MONOLITHICS | OP-07/CP |
| A5U3 | 17606 | IC QUAD SPST ANALOG SWITCH | SILICONIX | DG211CJ |
| A5U4 | 15093 | INTEGRATED CKT LM399H | NATIONAL SEMICONDUCTOR | LM399H |
| A5U5 | 13471 | INTEGRATED CKT LM324N | SIGNETICS | LM324AN |
| A5U6 | 17035 | I.C. - DIGITAL TTL | ANALOG DEVICES | AD7534JN |
| A5U7 | 15233 | I C CA3240E DUAL BIMOS OP AMP | RCA | CA3240E |
| A5U8 | 15135 | INTEGRATED CKT HA7-5135-5 | PRECISION MONOLITHICS | OP-07/CP |
| A5U9 | 17606 | IC QUAD SPST ANALOG SWITCH | SILICONIX | DG211CJ |
| A5U10 | 15135 | INTEGRATED CKT HA7-5135-5 | PRECISION MONOLITHICS | OP-07/CP |
| A5U11 | 15135 | INTEGRATED CKT HA7-5135-5 | PRECISION MONOLITHICS | OP-07/CP |
| A5U12 | 13471 | INTEGRATED CKT LM324N | SIGNETICS | LM324AN |
| A5U13 | 14641 | INTEGRATED CKT 8255 | HARRIS CORP | CP82C55A |
| A5U14 | 13470-047 | INTEGRATED CKT SN74LS32N | TEXAS INSTRUMENTS | SN74LS32N |
| A5U15 | 13470-004 | INTEGRATED CKT SN74LS04N | TEXAS INSTRUMENTS | SN74LS04N |
| A5U16 | 13470-044 | INTEGRATED CKT SN74LS138N | TEXAS INSTRUMENTS | SN74LS138N |
| A5U17 | 13470-005 | INTEGRATED CKT SN74LS08N | TEXAS INSTRUMENTS | SN74LS08N |
| A5U18 | 15141 | IC, VOLT QUAD COMP LM339N | NATIONAL SEMICONDUCTOR | LM339N |
| A5U19 | 14621 | INTEGRATED CKT LM358N | NATIONAL SEMICONDUCTOR | LM358N |
| A5U20 | 19586 | IC, 256 BIT NONVOL STATIC RAM | XICOR | X2444 |
| A5W1 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A5XQ1 | 11037 | SPACER, NYLON TO-5 | ARROW ELECTRONICS | THERMALLOY 7717-22-N |
| A5XW1 | 17240-001 | JUMPER, INSULATED 2 POS | MOLEX, INC. | 15-38-1024 |

## ANALOG PC BOARD ASSEMBLY #17288

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A6C1 | 14119-006 | CAP POLYSTY 4700PF 2.5% 160V | MALLORY | SXM247 |
| A6C2 | 19598-002 | CAP ELCTLT RDL 47uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E470MAA |
| A6C3 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C4 | 10001-003 | CAP CER 10pF 5% 1000VDC | SPRAGUE ELECTRIC CO. | 10TCC-Q10 |
| A6C5 | 10001-003 | CAP CER 10pF 5% 1000VDC | SPRAGUE ELECTRIC CO. | 10TCC-Q10 |
| A6C6 | 19599-002 | CAP ELCTLT RDL 100uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H101MPA |
| A6C7 | 19599-002 | CAP ELCTLT RDL 100uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H101MPA |
| A6C8 | 15640-001 | CAP CER USTBLE 100PF 10% 100V | SPRAGUE ELECTRIC CO. | 1CC00101X9100C4 |
| A6C9 | 15640-001 | CAP CER USTBLE 100PF 10% 100V | SPRAGUE ELECTRIC CO. | 1CC00101X9100C4 |
| A6C10 | 14119-008 | CAP POLYSTY 1200PF 2.5% 160V | MALLORY | SXM212 |
| A6C11 | 14119-001 | POLYSTYRENE .01MF 2.5% | MALLORY | WSXM\110 |
| A6C12 | 14119-006 | CAP POLYSTY 4700PF 2.5% 160V | MALLORY | SXM247 |
| A6C13 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A6C14 | 15776-003 | CAP,CER .022 MFD 10% 50V | CENTRALAB | CW15C223K |
| A6C15 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C16 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C17 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A6C18 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C19 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C20 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C21 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C22 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C23 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C24 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C25 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C26 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C27 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C28 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C29 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C30 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C31 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C32 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C33 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C34 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C35 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C36 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C37 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C38 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C39 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C40 | 15776-018 | CAP, Ceramic,4700pF X7R, 50V | CENTRALAB | CW15C472K |
| A6C41 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C43 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A6C44 | 15776-004 | CAP,CER .0022 MFD 10% 50V | CENTRALAB | CW15C222K |
| A6C45 | 14119-008 | CAP POLYSTY 1200PF 2.5% 160V | MALLORY | SXM212 |
| A6C46 | 14119-001 | POLYSTYRENE .01MF 2.5% | MALLORY | #SXM\110 |
| A6C47 | 14119-006 | CAP POLYSTY 4700PF 2.5% 160V | MALLORY | SXM247 |
| A6C48 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A6C49 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A6C50 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A6C51 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A6C52 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A6C53 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A6C54 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A6C55 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A6C56 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A6C57 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A6C58 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C59 | 10909-009 | CAP MICA 100PF 1% 500V | ARCO | CM05FD101F03 |
| A6C60 | 10909-009 | CAP MICA 100PF 1% 500V | ARCO | CM05FD101F03 |
| A6C61 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C62 | 15776-007 | CAP,CER. 470PF 10% 50V | CENTRALAB | CW15C471K |
| A6C63 | 15640-001 | CAP CER USTBLE 100PF 10% 100V | SPRAGUE ELECTRIC CO. | 1CC00101X9100C4 |
| A6C64 | 15640-005 | CAP CER USTBLE .001MF 10% 100V | MURATA/ERIE CORP | RPE121C00102K100V |
| A6C65 | 15640-001 | CAP CER USTBLE 100PF 10% 100V | SPRAGUE ELECTRIC CO. | 1CC00101X9100C4 |
| A6C66 | 15776-003 | CAP,CER .022 MFD 10% 50V | CENTRALAB | CW15C223K |
| A6C67 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6C68 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A6CR1 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A6CR2 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A6CR3 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A6CR4 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A6P1 | 19181-001 | CONN DIN MALE C ANG(AC)64 POS | PANDUIT | 100-964-053 |
| A6R1 | 10013-029 | RES DEP CARB 2.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R13 | 10013-045 | RES DEP CARB 47K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R14 | 10013-086 | RES CARB FILM 51 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A6R15 | 10013-013 | RES DEP CARB 100 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R16 | 10015-299 | RES MET FILM 51.1K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D51.1KOHM1% |
| A6R17 | 10015-195 | RES MET FILM 200 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 200 OHM 1% |
| A6R18 | 10015-299 | RES MET FILM 51.1K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D51.1KOHM1% |
| A6R19 | 10015-014 | RES MET FILM 31.6K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 31.6K OHM 1% |
| A6R20 | 12449-019 | RES MF 1.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A6R21 | 10015-014 | RES MET FILM 31.6K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 31.6K OHM 1% |
| A6R22 | 10013-021 | RES DEP CARB 470 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R23 | 12449-123 | RES MF 367.2K OHM 0.1% 1/8W | PRECISION RESISTIVE PRODU | GP1/4 T100 367.2K 0.1% |
| A6R24 | 12449-124 | RES MF 300.0K OHM 0.1% 1/8W | PRECISION RESISTIVE PRODU | GP1/4 T100 300.0K 0.1% |
| A6R25 | 12449-123 | RES MF 367.2K OHM 0.1% 1/8W | PRECISION RESISTIVE PRODU | GP1/4 T100 367.2K 0.1% |
| A6R26 | 12449-030 | RES MF 30.0 K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A6R27 | 12449-030 | RES MF 30.0 K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A6R28 | 12449-030 | RES MF 30.0 K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A6R29 | 12449-057 | RES MF 33.33K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A6R30 | 10015-254 | RES MET FILM 8.45K 1% 1/8W | CORNING GLASS WORKS | RN55D 8.45K OHM 1% |
| A6R31 | 10015-217 | RES MET FILM 1.21K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1.21K OHM 1% |
| A6R32 | 10015-207 | RES MET FILM 20.0K OHM 1% 1/8W | CORNING GLASS WORKS | 20K OHM 1% |
| A6R33 | 10015-218 | RES MET FILM 40.2K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 40.2K OHM 1% |
| A6R34 | 10015-081 | RES MET FILM 11.3K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 11.3K OHM 1% |
| A6R35 | 10015-183 | RES MET FILM 80.6K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 80.6K OHM 1% |
| A6R37 | 10015-012 | RES MET FILM 9.09K OHM 1 % 1/8 | CORNING GLASS WORKS | RN55D 9.09K OHM 1% |
| A6R38 | 10015-064 | RES MET FILM 1.13K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1.13K OHM 1% |
| A6R39 | 10015-337 | RES MET FILM 4.02M 1% 1/8W | CORNING GLASS WORKS | RN55D4.02MOHM1% |
| A6R40 | 10015-015 | RES MET FILM 21.5K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 21.5K OHM 1% |
| A6R41 | 10015-207 | RES MET FILM 20.0K OHM 1% 1/8W | CORNING GLASS WORKS | 20K OHM 1% |
| A6R42 | 10015-233 | RES MET FILM 174K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 174K OHM 1% |
| A6R43 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R44 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R45 | 10013-056 | RES CARB FILM 390K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FXXXJ |
| A6R46 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R47 | 10015-084 | RES MET FILM 2.10K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 2.10K OHM 1% |
| A6R48 | 12449-092 | RES MF 8.250K OHM 0.1% 1/8W | DALE ELECTRONICS | MFF 1/8 T2 |
| A6R49 | 12449-125 | RES MF 1.05K OHM 0.1% 1/8W | PRECISION RESISTIVE PRODU | GP1/4 T100 1.050K 0.1% |
| A6R50 | 12449-074 | RES MF 1.182K OHM 0.1% 1/8W | DALE ELECTRONICS | MFF 1/8 T2 1.182K OHM.1% |
| A6R51 | 10015-075 | RES MET FILM 1.33K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1.33K OHM 1% |
| A6R52 | 10015-340 | RES MET FILM 1.87K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D1.87KOHM1% |
| A6R53 | 10015-013 | RES MET FILM 100K OHM 1 % 1/8W | CORNING GLASS WORKS | RN55D 100K OHM 1% |
| A6R54 | 10015-013 | RES MET FILM 100K OHM 1 % 1/8W | CORNING GLASS WORKS | RN55D 100K OHM 1% |
| A6R55 | 12449-021 | RES MF 10.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A6R56 | 12449-021 | RES MF 10.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A6R57 | 12449-092 | RES MF 8.250K OHM 0.1% 1/8W | DALE ELECTRONICS | MFF 1/8 T2 |
| A6R58 | 12449-074 | RES MF 1.182K OHM 0.1% 1/8W | DALE ELECTRONICS | MFF 1/8 T2 1.182K OHM.1% |
| A6R59 | 12449-092 | RES MF 8.250K OHM 0.1% 1/8W | DALE ELECTRONICS | MFF 1/8 T2 |
| A6R60 | 12449-074 | RES MF 1.182K OHM 0.1% 1/8W | DALE ELECTRONICS | MFF 1/8 T2 1.182K OHM.1% |
| A6R61 | 10015-164 | RES MET FILM 475 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 475 OHM 1% |
| A6R62 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R63 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R64 | 10013-056 | RES CARB FILM 390K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FXXXJ |
| A6R65 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R66 | 10015-217 | RES MET FILM 1.21K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1.21K OHM 1% |
| A6R67 | 10015-245 | RES MET FILM 41.2K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 41.2K OHM 1% |
| A6R68 | 10013-021 | RES DEP CARB 470 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R69 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A6R70 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A6R71 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A6R72 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A6R73 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |
| A6R74 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC070F470J |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A6R75 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R76 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R77 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R78 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R79 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R80 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R81 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R82 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R83 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R84 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R85 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R86 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R87 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R88 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R89 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R90 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R91 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R92 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R93 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R95 | 10013-036 | RES CARB FILM 8.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R96 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R97 | 10013-076 | RES DEP CARB 6.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R98 | 10015-208 | RES MET FILM 124K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 124K OHM 1% |
| A6R99 | 10015-212 | RES MET FILM 133K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 133K OHM 1% |
| A6R102 | 10015-268 | RES MET FILM 6.34K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 6.34K OHM 1% 1/8W |
| A6R103 | 12449-037 | RES MF 20.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A6R105 | 10015-338 | RES MET FILM 4.42K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D4.42KOHM1% |
| A6R106 | 10015-079 | RES MET FILM 2.67K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 2.67K OHM 1% |
| A6R107 | 10015-290 | RES,MF,1/8W,1%,3.74K | NOT FOUND | RN55D-3741F |
| A6R108 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A6R109 | 10015-019 | RES MET FILM 1.0K OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 1K OHM 1% |
| A6R110 | 10015-007 | RES MET FILM 10.0K OHM 1% 1/8W | LARTRONICS, INC. | 10.0K OHM 1% 1/8W |
| A6R111 | 10015-007 | RES MET FILM 10.0K OHM 1% 1/8W | LARTRONICS, INC. | 10.0K OHM 1% 1/8W |
| A6R112 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R113 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A6R114 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6R115 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A6RP1 | 15098-002 | RES NETWORK 10K OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108A103 |
| A6TP1 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A6TP2 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A6TP3 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A6TP4 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A6TP5 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A6TP6 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A6TP7 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A6TP8 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A6TP9 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A6U1 | 13470-001 | INTEGRATED CKT SN74LS00N | TEXAS INSTRUMENTS | SN74LS00N |
| A6U2 | 17048-004 | IC OCTAL D-TYPE TRANS LATCHES | TEXAS INSTRUMENTS | SN74HCT373N |
| A6U3 | 13470-001 | INTEGRATED CKT SN74LS00N | TEXAS INSTRUMENTS | SN74LS00N |
| A6U5 | 14641 | INTEGRATED CKT 8255 | HARRIS CORP | CP82C55A |
| A6U6 | 13470-001 | INTEGRATED CKT SN74LS00N | TEXAS INSTRUMENTS | SN74LS00N |
| A6U7 | 17597 | DATA ACQ CMOS Dual 8-Bit Buff | ANALOG DEVICES | AD7528JN |
| A6U8 | 17021 | I.C. - DIGITAL TTL | ANALOG DEVICES | AD574AJN |
| A6U9 | 20292 | PAL, ANALOG AUTORANGE | WAVETEK MICROWAVE | PER WMI # 20292 |
| A6U10 | 13470-018 | INTEGRATED CKT SN74LS221N | TEXAS INSTRUMENTS | SN74LS221N |
| A6U11 | 20293 | PAL, ANALOG ADDRESS DECODER | WAVETEK MICROWAVE | PER WMI #20293 |
| A6U12 | 13470-049 | INTEGRATED CKT SN74LS244N | TEXAS INSTRUMENTS | SN74LS244N |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A6U13 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A6U14 | 15119 | INTEGRATED CKT DG201CJ | SILICONIX | DG201ACJ |
| A6U16 | 16325 | INTEGRATED CKT LF398AN | SIGNETICS | LF398N |
| A6U17 | 13470-001 | INTEGRATED CKT SN74LS00N | TEXAS INSTRUMENTS | SN74LS00N |
| A6U18 | 13470-062 | INTEGRATED CKT SN74LS139N | NATIONAL SEMICONDUCTOR | DM74LS139N |
| A6U20 | 15119 | INTEGRATED CKT DG201CJ | SILICONIX | DG201ACJ |
| A6U21 | 13470-004 | INTEGRATED CKT SN74LS04N | TEXAS INSTRUMENTS | SN74LS04N |
| A6U22 | 19958 | HIGH PRFM ML OPNL AMPL | FAIRCHILD | UA741TC |
| A6U23 | 19490 | INTEGRATED CKT MC34074 | MOTOROLA (SPD) | MC34074P |
| A6U24 | 15135 | INTEGRATED CKT HA7-5135-5 | PRECISION MONOLITHICS | OP-07/CP |
| A6U25 | 15141 | IC, VOLT QUAD COMP LM339N | NATIONAL SEMICONDUCTOR | LM339N |
| A6U26 | 15119 | INTEGRATED CKT DG201CJ | SILICONIX | DG201ACJ |
| A6U27 | 15119 | INTEGRATED CKT DG201CJ | SILICONIX | DG201ACJ |
| A6U28 | 19490 | INTEGRATED CKT MC34074 | MOTOROLA (SPD) | MC34074P |
| A6U29 | 19218 | IC 4-CHAN CMOS DIFF ANLG MUX | SILICONIX | DG509CJ |
| A6U30 | 15119 | INTEGRATED CKT DG201CJ | SILICONIX | DG201ACJ |
| A6U31 | 19985 | IC PREC OP AMP HI SPEED | LINEAR TECHNOLOGY | LT1007ACN8 |
| A6U32 | 19985 | IC PREC OP AMP HI SPEED | LINEAR TECHNOLOGY | LT1007ACN8 |
| A6U33 | 20291 | PAL, ANALOG DEGLITCH | WAVETEK MICROWAVE | PER WMI #20291 |
| A6U34 | 15119 | INTEGRATED CKT DG201CJ | SILICONIX | DG201ACJ |

## DIGITAL INTERCONNECT PC BOARD ASSEMBLY #17707

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A9C1 | 11501-005 | CAP CER 0.47UF 20% 50V | ERIE TECHNOLOGICAL | 8131-050-Z5U-474M |
| A9C2 | 11501-005 | CAP CER 0.47UF 20% 50V | ERIE TECHNOLOGICAL | 8131-050-Z5U-474M |
| A9C3 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A9C4 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A9C5 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A9C6 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A9C7 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A9C8 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A9C9 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A9C10 | 11501-008 | CAP CER .01UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U103M50V |
| A9C11 | 19607-002 | CAP ELCTLT RDL 2200uF 20% 10V | NICHICON (AMERICA) CORP. | ULB1A222MRA |
| A9J1 | 19501-001 | CONN DIN FEM STR C(ABC) 96 POS | PANDUIT | 100-096-453 |
| A9J2 | 19501-001 | CONN DIN FEM STR C(ABC) 96 POS | PANDUIT | 100-096-453 |
| A9J3 | 19501-001 | CONN DIN FEM STR C(ABC) 96 POS | PANDUIT | 100-096-453 |
| A9J4 | 19501-001 | CONN DIN FEM STR C(ABC) 96 POS | PANDUIT | 100-096-453 |
| A9J5 | 19501-001 | CONN DIN FEM STR C(ABC) 96 POS | PANDUIT | 100-096-453 |
| A9J6 | 19501-001 | CONN DIN FEM STR C(ABC) 96 POS | PANDUIT | 100-096-453 |
| A9J7 | 19183-001 | CONN HDR HSG MATE-N-LOK 6PINS | AMP, INC. | 1-380999-0 |
| A9RP1 | 14882-005 | RES SIP 470 OHM 2% OHM 1/8W | ALLEN-BRADLEY CO. | 110A471 |
| A9RP2 | 14882-004 | RES SIP 330 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 110A331 |
| A9RP3 | 14882-004 | RES SIP 330 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 110A331 |
| A9RP4 | 14882-005 | RES SIP 470 OHM 2% OHM 1/8W | ALLEN-BRADLEY CO. | 110A471 |
| A9RP5 | 14882-004 | RES SIP 330 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 110A331 |
| A9RP6 | 14882-005 | RES SIP 470 OHM 2% OHM 1/8W | ALLEN-BRADLEY CO. | 110A471 |
| A9RP7 | 14882-004 | RES SIP 330 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 110A331 |
| A9RP8 | 14882-005 | RES SIP 470 OHM 2% OHM 1/8W | ALLEN-BRADLEY CO. | 110A471 |
| A9RP9 | 14882-004 | RES SIP 330 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 110A331 |
| A9RP10 | 14882-005 | RES SIP 470 OHM 2% OHM 1/8W | ALLEN-BRADLEY CO. | 110A471 |
| A9RP11 | 14882-004 | RES SIP 330 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 110A331 |
| A9RP12 | 14882-005 | RES SIP 470 OHM 2% OHM 1/8W | ALLEN-BRADLEY CO. | 110A471 |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A9RP13 | 14882-004 | RES SIP 330 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 110A331 |
| A9RP14 | 14882-005 | RES SIP 470 OHM 2% OHM 1/8W | ALLEN-BRADLEY CO. | 110A471 |
| A9RP15 | 14882-005 | RES SIP 470 OHM 2% OHM 1/8W | ALLEN-BRADLEY CO. | 110A471 |
| A9RP16 | 14882-004 | RES SIP 330 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 110A331 |

## PERIPHERAL/MEMORY PC BOARD ASSEMBLY #17153

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A10C1 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C2 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C3 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C4 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C5 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C6 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C7 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C8 | 19599-004 | CAP ELCTLT RDL 4.7uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H4R7MAA |
| A10C9 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C10 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C11 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C12 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C13 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C14 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A10C15 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C16 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A10C17 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C18 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C19 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C20 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C21 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C22 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C23 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A10C24 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A10C25 | 11501-009 | CAP CER .001UF 20% 50VDC | MURATA/ERIE CORP | RPE121Z5U102M50V |
| A10C26 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C27 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A10C28 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A10C29 | 16258-001 | CAP MET MYLAR 1.0MFD 50V 10% | WIMA | MKS\1.0UF\10% |
| A10C30 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C31 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C32 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C33 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C34 | 19599-004 | CAP ELCTLT RDL 4.7uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H4R7MAA |
| A10C35 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C36 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C37 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C38 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C39 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C40 | 19599-004 | CAP ELCTLT RDL 4.7uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H4R7MAA |
| A10C41 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C42 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C43 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C44 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A10C48 | 16258-001 | CAP MET MYLAR 1.0MFD 50V 10% | WIMA | MKS\1.0UF\10% |
| A10J2 | 19182-001 | CONN HDR MALE PCB W/LK 64 POS | 3M COMPANY | 3764-6202 |
| A10P1 | 19181-002 | CONN DIN MALE C ANG(ABC) 96POS | PANDUIT | 100-096-053 |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A10P2 | 19180-001 | CONN DIN MALE B ANG(AB)64 POS | PANDUIT | 100-064-053 |
| A10Q1 | 10019 | TRANSISTOR 2N3565 | NATIONAL SEMICONDUCTOR | 2N3565 |
| A10Q2 | 13904 | TRANSISTOR POWER TIP 30 | TEXAS INSTRUMENTS | TIP30 |
| A10R1 | 10013-042 | RES CARB FILM 27K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R2 | 10013-049 | RES DEP CARB 100K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R3 | 10013-029 | RES DEP CARB 2.2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R4 | 10013-039 | RES DEP CARB 15K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R5 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R6 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R7 | 10013-065 | RES DEP CARB 2.2M OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R8 | 10013-041 | RES DEP CARB 22K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R9 | 10013-041 | RES DEP CARB 22K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R10 | 10013-065 | RES DEP CARB 2.2M OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R11 | 10013-013 | RES DEP CARB 100 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R12 | 10013-049 | RES DEP CARB 100K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R13 | 10013-001 | RES DEP CARB 10 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R14 | 10013-001 | RES DEP CARB 10 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10R15 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A10RP1 | 15098-007 | RES SIP(8X7R) 27K OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108A273 |
| A10RP2 | 15098-007 | RES SIP(8X7R) 27K OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108A273 |
| A10RP3 | 14881-001 | RES SIP(8x4R) 220 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108B221 |
| A10RP4 | 15098-002 | RES NETWORK 10K OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108A103 |
| A10RP5 | 15098-011 | RES SIP(8X7R) 2.2KOHM 2% 1/8W | ALLEN-BRADLEY CO. | 108A222 |
| A10S1 | 14677 | SWITCH, DIP 5 POS SPST | GRAYHILL | 76SB05 |
| A10TP1 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A10TP2 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A10U1 | 13470-005 | INTEGRATED CKT SN74LS08N | TEXAS INSTRUMENTS | SN74LS08N |
| A10U2 | 13470-015 | INTEGRATED CKT SN74LS90N | TEXAS INSTRUMENTS | SN74LS90N |
| A10U3 | 13470-047 | INTEGRATED CKT SN74LS32N | TEXAS INSTRUMENTS | SN74LS32N |
| A10U4 | 13470-047 | INTEGRATED CKT SN74LS32N | TEXAS INSTRUMENTS | SN74LS32N |
| A10U5 | 13470-049 | INTEGRATED CKT SN74LS244N | TEXAS INSTRUMENTS | SN74LS244N |
| A10U6 | 13470-044 | INTEGRATED CKT SN74LS138N | TEXAS INSTRUMENTS | SN74LS138N |
| A10U7 | 19436-001 | I.C 32, 768 x 8-BIT STATIC RAM | NEC | uPD43256 |
| A10U8 | 19436-001 | I.C 32, 768 x 8-BIT STATIC RAM | NEC | uPD43256 |
| A10U9 | 19436-001 | I.C 32, 768 x 8-BIT STATIC RAM | NEC | uPD43256 |
| A10U10 | 19436-001 | I.C 32, 768 x 8-BIT STATIC RAM | NEC | uPD43256 |
| A10U11 | 13470-006 | INTEGRATED CKT SN74LS10N | TEXAS INSTRUMENTS | SN74LS10N |
| A10U12 | 13470-006 | INTEGRATED CKT SN74LS10N | TEXAS INSTRUMENTS | SN74LS10N |
| A10U13 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U14 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U15 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U16 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U17 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U18 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U19 | 17114 | IC, GPIB CONTROLLER | TEXAS INSTRUMENTS | TMS9914ANL |
| A10U20 | 17113-001 | IC, OCTAL GPIB XCVR | TEXAS INSTRUMENTS | SN75160AN |
| A10U21 | 17113-002 | IC, OCTAL GPIB XCVR | TEXAS INSTRUMENTS | SN75162AN |
| A10U22 | 13470-049 | INTEGRATED CKT SN74LS244N | TEXAS INSTRUMENTS | SN74LS244N |
| A10U23 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A10U24 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A10U25 | 13470-001 | INTEGRATED CKT SN74LS00N | TEXAS INSTRUMENTS | SN74LS00N |
| A10U26 | 13470-004 | INTEGRATED CKT SN74LS04N | TEXAS INSTRUMENTS | SN74LS04N |
| A10U27 | 13470-004 | INTEGRATED CKT SN74LS04N | TEXAS INSTRUMENTS | SN74LS04N |
| A10U28 | 13470-047 | INTEGRATED CKT SN74LS32N | TEXAS INSTRUMENTS | SN74LS32N |
| A10U29 | 13470-013 | INTEGRATED CKT SN74LS74N | TEXAS INSTRUMENTS | SN74LS74N |
| A10U30 | 13470-006 | INTEGRATED CKT SN74LS10N | TEXAS INSTRUMENTS | SN74LS10N |
| A10U31 | 19220 | IC DYNAMIC RAM CONTROLLER | TEXAS INSTRUMENTS | TMS4500A-15NL |
| A10U32 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A10U33 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U34 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U35 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U36 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U37 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U38 | 17024 | INTEGRATED CKT D8279 | INTEL | D8279 |
| A10U39 | 13470-064 | INTEGRATED CKT SN74LS156N | MOTOROLA (SPD) | SN74LS156N |
| A10U40 | 13470-046 | INTEGRATED CIRCUIT SN74LS161AN | TEXAS INSTRUMENTS | SN74LS161AN |
| A10U41 | 13470-018 | INTEGRATED CKT SN74LS221N | TEXAS INSTRUMENTS | SN74LS221N |
| A10U42 | 13470-060 | INTEGRATED CKT SN74LS164N | TEXAS INSTRUMENTS | SN74LS164N |
| A10U43 | 13470-060 | INTEGRATED CKT SN74LS164N | TEXAS INSTRUMENTS | SN74LS164N |
| A10U44 | 19566-032 | TRIPLE 3 INPUT NAND | NATIONAL SEMICONDUCTOR | 74HC10N |
| A10U45 | 13470-009 | INTEGRATED CKT SN74LS27N | TEXAS INSTRUMENTS | SN74LS27N |
| A10U46 | 13470-013 | INTEGRATED CKT SN74LS74N | TEXAS INSTRUMENTS | SN74LS74N |
| A10U47 | 13470-013 | INTEGRATED CKT SN74LS74N | TEXAS INSTRUMENTS | SN74LS74N |
| A10U48 | 13470-011 | INTEGRATED CKT SN74LS38N | TEXAS INSTRUMENTS | SN74LS38N |
| A10U49 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U50 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U51 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U52 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464P-112 |
| A10U53 | 17128 | IC PROGRAMMABLE SND GEN | GENERAL INSTRUMENTS | AY-3-8913 |
| A10U54 | 17212 | IC, DUAL TIMER | NATIONAL SEMICONDUCTOR | LM556N |
| A10U55 | 14621 | INTEGRATED CKT LM358N | NATIONAL SEMICONDUCTOR | LM358N |
| A10U56 | 20295 | PAL, ROTARY ENCODER DECODER | WAVETEK MICROWAVE | PER WMI #20295 |
| A10U57 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A10U58 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A10U59 | 13470-044 | INTEGRATED CKT SN74LS138N | TEXAS INSTRUMENTS | SN74LS138N |
| A10U60 | 13470-044 | INTEGRATED CKT SN74LS138N | TEXAS INSTRUMENTS | SN74LS138N |
| A10U61 | 20294 | PAL, PER/MEM INTERUPT DECODER | WAVETEK MICROWAVE | PER WMI #20294 |
| A10U62 | 11270-034 | INTEGRATED CKT 7407 | TEXAS INSTRUMENTS | SN7407N |
| A10U63 | 13470-049 | INTEGRATED CKT SN74LS244N | TEXAS INSTRUMENTS | SN74LS244N |
| A10U64 | 13470-004 | INTEGRATED CKT SN74LS04N | TEXAS INSTRUMENTS | SN74LS04N |
| A10U65 | 20296 | PAL, PER/MEM ADDRESS DECODER | WAVETEK MICROWAVE | PER WMI #20296 |
| A10U66 | 13470-045 | INTEGRATED CKT SN74LS240N | TEXAS INSTRUMENTS | SN74LS240N |
| A10U67 | 13470-069 | IC OCTAL BUS TRANSCEIVERS | TEXAS INSTRUMENTS | SN74LS645N |
| A10U68 | 13470-069 | IC OCTAL BUS TRANSCEIVERS | TEXAS INSTRUMENTS | SN74LS645N |
| A10W5 | 17240-001 | JUMPER, INSULATED 2 POS | MOLEX, INC. | 15-38-1024 |
| A10W6 | 17240-001 | JUMPER, INSULATED 2 POS | MOLEX, INC. | 15-38-1024 |
| A10W8 | 17240-001 | JUMPER, INSULATED 2 POS | MOLEX, INC. | 15-38-1024 |

## GRAPHICS PC BOARD ASSEMBLY #16922

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A11C1 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C2 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C3 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C4 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C5 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C6 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C7 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C8 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C9 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C10 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C11 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C12 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A11C13 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C14 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C15 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C16 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C17 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C18 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C19 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C20 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C21 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C22 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C23 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C24 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C25 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C26 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C27 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C28 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C29 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C30 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C31 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C33 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C34 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C35 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C36 | 19599-008 | CAP ELCTLT RDL 15uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H150MAA |
| A11C37 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C38 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C39 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C40 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C41 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C42 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C43 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C44 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C45 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11C46 | 19599-007 | CAP ELCTLT RDL 22uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H220MAA |
| A11C47 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A11CR1 | 11345 | DIODE HPA 2900 | HEWLETT PACKARD | 5082-2900 |
| A11CR2 | 11345 | DIODE HPA 2900 | HEWLETT PACKARD | 5082-2900 |
| A11CR3 | 11345 | DIODE HPA 2900 | HEWLETT PACKARD | 5082-2900 |
| A11CR4 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A11L1 | 10631-017 | COIL, RF MLD .22uH 10% | DELEVAN | 1025-04 |
| A11L2 | 10631-017 | COIL, RF MLD .22uH 10% | DELEVAN | 1025-04 |
| A11L3 | 10631-017 | COIL, RF MLD .22uH 10% | DELEVAN | 1025-04 |
| A11P1 | 19181-002 | CONN DIN MALE C ANG(ABC) 96POS | PANDUIT | 100-096-053 |
| A11P2 | 19180-001 | CONN DIN MALE B ANG(AB)64 POS | PANDUIT | 100-064-053 |
| A11Q1 | 10398 | TRANSISTOR 2N4121 OR PN4917 | NATIONAL SEMICONDUCTOR | 2N4121 |
| A11Q2 | 10398 | TRANSISTOR 2N4121 OR PN4917 | NATIONAL SEMICONDUCTOR | 2N4121 |
| A11Q3 | 10398 | TRANSISTOR 2N4121 OR PN4917 | NATIONAL SEMICONDUCTOR | 2N4121 |
| A11Q4 | 10398 | TRANSISTOR 2N4121 OR PN4917 | NATIONAL SEMICONDUCTOR | 2N4121 |
| A11Q5 | 10398 | TRANSISTOR 2N4121 OR PN4917 | NATIONAL SEMICONDUCTOR | 2N4121 |
| A11Q6 | 10398 | TRANSISTOR 2N4121 OR PN4917 | NATIONAL SEMICONDUCTOR | 2N4121 |
| A11Q7 | 10398 | TRANSISTOR 2N4121 OR PN4917 | NATIONAL SEMICONDUCTOR | 2N4121 |
| A11R1 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A11R2 | 10015-003 | RES MET FILM 49.9 OHM 1% 1/8W | LARTRONICS, INC. | RN55D 49.9 OHM 1% 1/8W |
| A11R3 | 10015-003 | RES MET FILM 49.9 OHM 1% 1/8W | LARTRONICS, INC. | RN55D 49.9 OHM 1% 1/8W |
| A11R4 | 10015-003 | RES MET FILM 49.9 OHM 1% 1/8W | LARTRONICS, INC. | RN55D 49.9 OHM 1% 1/8W |
| A11R5 | 10015-003 | RES MET FILM 49.9 OHM 1% 1/8W | LARTRONICS, INC. | RN55D 49.9 OHM 1% 1/8W |
| A11R6 | 10015-003 | RES MET FILM 49.9 OHM 1% 1/8W | LARTRONICS, INC. | RN55D 49.9 OHM 1% 1/8W |
| A11R7 | 10015-003 | RES MET FILM 49.9 OHM 1% 1/8W | LARTRONICS, INC. | RN55D 49.9 OHM 1% 1/8W |
| A11R8 | 10015-126 | RES MET FILM 34 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A11R9 | 10015-186 | RES MET FILM 10.0 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 10 OHM 1% |
| A11R10 | 10015-186 | RES MET FILM 10.0 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 10 OHM 1% |
| A11R11 | 10015-126 | RES MET FILM 34 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D |
| A11R12 | 10015-186 | RES MET FILM 10.0 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 10 OHM 1% |
| A11R13 | 10015-126 | RES MET FILM 34 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D |
| A11R14 | 10013-017 | RES DEP CARB 220 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A11R15 | 10015-197 | RES MET FILM 221 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 221 OHM 1% |
| A11R16 | 10015-205 | RES MET FILM 768 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 768 OHM 1% |
| A11R17 | 10013-023 | RES DEP CARB 680 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A11R18 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A11R19 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A11RP1 | 14882-001 | RES NETWK 10K OHM 2% 125MW | ALLEN-BRADLEY CO. | 110A103 |
| A11RP2 | 14881-007 | RES SIP(8X4R) 330 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108B331 |
| A11RP3 | 14881-013 | RES SIP(8x4R) 2K OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108B202 |
| A11RP4 | 14881-012 | RES SIP(8X4R) 10KOHM 2% 1/8W | ALLEN-BRADLEY CO. | 108B103 |
| A11RP5 | 14881-012 | RES SIP(8X4R) 10KOHM 2% 1/8W | ALLEN-BRADLEY CO. | 108B103 |
| A11RP6 | 14881-013 | RES SIP(8x4R) 2K OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108B202 |
| A11RP7 | 14881-007 | RES SIP(8X4R) 330 OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108B331 |
| A11RP8 | 15098-012 | RES SIP (8X7R) 1K OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108A102 |
| A11S1 | 14891 | 8 POS. DIP ROCKER SWITCH | GRAYHILL | 76sb08 |
| A11TP1 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A11TP2 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A11U1 | 13470-046 | INTEGRATED CIRCUIT SN74LS161AN | TEXAS INSTRUMENTS | SN74LS161AN |
| A11U2 | 20960-002 | IC 8 BIT PAR-IN/S OUT SHF RGTR | SIEMENS | N74F166N |
| A11U3 | 20960-002 | IC 8 BIT PAR-IN/S OUT SHF RGTR | SIEMENS | N74F166N |
| A11U4 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U5 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U6 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U7 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U8 | 17048-010 | I/C DUAL 4-INPUT NAND GATE | SIGNETICS | HCT20N |
| A11U9 | 20960-002 | IC 8 BIT PAR-IN/S OUT SHF RGTR | SIEMENS | N74F166N |
| A11U10 | 20960-002 | IC 8 BIT PAR-IN/S OUT SHF RGTR | SIEMENS | N74F166N |
| A11U11 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U12 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U13 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U14 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U15 | 13470-020 | INTEGRATED CKT SN74LS257N | TEXAS INSTRUMENTS | SN74LS257N |
| A11U16 | 13470-020 | INTEGRATED CKT SN74LS257N | TEXAS INSTRUMENTS | SN74LS257N |
| A11U17 | 20960-001 | IC QUAD INPUT AND GATE | RCA | CD74ACT08E |
| A11U18 | 20960-002 | IC 8 BIT PAR-IN/S OUT SHF RGTR | SIEMENS | N74F166N |
| A11U19 | 20960-002 | IC 8 BIT PAR-IN/S OUT SHF RGTR | SIEMENS | N74F166N |
| A11U20 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U21 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U22 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U23 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U24 | 20960-003 | IC QUAD D FLIP FLOP W/RESET | RCA | CD74ACT175E |
| A11U25 | 20960-002 | IC 8 BIT PAR-IN/S OUT SHF RGTR | SIEMENS | N74F166N |
| A11U26 | 20960-002 | IC 8 BIT PAR-IN/S OUT SHF RGTR | SIEMENS | N74F166N |
| A11U27 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U28 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U29 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U30 | 19995-001 | IC 64Kx4 @120ns DYNAMIC RAM | TEXAS INSTRUMENTS | TMS4464-12NL |
| A11U31 | 11332 | INTEGRATED CKT CA3054 | RCA | CA3054 |
| A11U32 | 11332 | INTEGRATED CKT CA3054 | RCA | CA3054 |
| A11U33 | 11332 | INTEGRATED CKT CA3054 | RCA | CA3054 |
| A11U34 | 17158-002 | IC HEX INVERTING DRIVERS | TEXAS INSTRUMENTS | SN74ALS1004N |
| A11U35 | 17048-011 | I/C QUAD 2-INPUT OR GATE | SIGNETICS | HCT32N |
| A11U36 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A11U37 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A11U38 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A11U39 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A11U40 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A11U41 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A11U42 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A11U43 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A11U44 | 19993 | IC CRT GRAPHIC CONTROLLER | NEC | uPD7220AD |
| A11U45 | 20960-003 | IC QUAD D FLIP FLOP W/RESET | RCA | CD74ACT175E |
| A11U46 | 19566-009 | IC QUAD 2-INP OR GATE | NATIONAL SEMICONDUCTOR | 74HC32N |
| A11U47 | 13473-008 | IC QUAD 2-INPUT NAND BUFFER | TEXAS INSTRUMENTS | SN74S37N |
| A11U48 | 13470-013 | INTEGRATED CKT SN74LS74N | TEXAS INSTRUMENTS | SN74LS74N |
| A11U49 | 20297 | PAL, SIGNALS INTERFACE | WAVETEK MICROWAVE | PER WMI #20297 |
| A11U50 | 13470-062 | INTEGRATED CKT SN74LS139N | NATIONAL SEMICONDUCTOR | DM74LS139N |
| A11U51 | 13470-005 | INTEGRATED CKT SN74LS08N | TEXAS INSTRUMENTS | SN74LS08N |
| A11U52 | 13470-060 | INTEGRATED CKT SN74LS164N | TEXAS INSTRUMENTS | SN74LS164N |
| A11U53 | 13470-001 | INTEGRATED CKT SN74LS00N | TEXAS INSTRUMENTS | SN74LS00N |
| A11U54 | 13470-013 | INTEGRATED CKT SN74LS74N | TEXAS INSTRUMENTS | SN74LS74N |
| A11U55 | 13470-013 | INTEGRATED CKT SN74LS74N | TEXAS INSTRUMENTS | SN74LS74N |
| A11U56 | 13470-011 | INTEGRATED CKT SN74LS38N | TEXAS INSTRUMENTS | SN74LS38N |
| A11U57 | 13470-060 | INTEGRATED CKT SN74LS164N | TEXAS INSTRUMENTS | SN74LS164N |
| A11U58 | 13470-044 | INTEGRATED CKT SN74LS138N | TEXAS INSTRUMENTS | SN74LS138N |
| A11U59 | 19193-001 | IC 8-BIT EQUIAL-TO COMPARATOR | AMD | AM25LS2521PC |
| A11U60 | 17048-004 | IC OCTAL D-TYPE TRANS LATCHES | TEXAS INSTRUMENTS | SN74HCT373N |
| A11U61 | 17048-005 | IC OCTAL D-TYPE FLIP-FLOP | TEXAS INSTRUMENTS | SN74HCT374N |
| A11U62 | 17048-005 | IC OCTAL D-TYPE FLIP-FLOP | TEXAS INSTRUMENTS | SN74HCT374N |
| A11U63 | 13470-069 | IC OCTAL BUS TRANSCEIVERS | TEXAS INSTRUMENTS | SN74LS645N |
| A11W1 | 17240-001 | JUMPER, INSULATED 2 POS | MOLEX, INC. | 15-38-1024 |
| A11XW1 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A11XW2 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A11Y1 | 19199 | IC CLK OSC 28.7539MHz @100ppM | COMCLOK | CCO 100A 28.7539MHz |

## CPU PC BOARD ASSEMBLY #16983

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A12C1 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C2 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C3 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A12C4 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A12C5 | 11501-005 | CAP CER 0.47UF 20% 50V | ERIE TECHNOLOGICAL | 8131-050-Z5U-474M |
| A12C6 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A12C7 | 10000-006 | CAP CER .0047MF 20% 500VDC | SPRAGUE ELECTRIC CO. | 50A-D47 |
| A12C8 | 10001-010 | CAP CER TC 20PF 5% 1000VDC | SPRAGUE ELECTRIC CO. | 10TCC-Q20 |
| A12C9 | 10001-003 | CAP CER 10pF 5% 1000VDC | SPRAGUE ELECTRIC CO. | 10TCC-Q10 |
| A12C10 | 10001-003 | CAP CER 10pF 5% 1000VDC | SPRAGUE ELECTRIC CO. | 10TCC-Q10 |
| A12C11 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C12 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C13 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C14 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C15 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C16 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C17 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C18 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C19 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C20 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A12C21 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C22 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C23 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C24 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C25 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C26 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C27 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C28 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C29 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C30 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C31 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C32 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C33 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C34 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C35 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C36 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C37 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C38 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C39 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C40 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C41 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C42 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C43 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C44 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A12C45 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A12C46 | 19599-001 | CAP ELCTLT RDL 10uF 20% 50V | NICHICON (AMERICA) CORP. | ULB1H100MAA |
| A12C47 | 19598-002 | CAP ELCTLT RDL 47uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E470MAA |
| A12C48 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C49 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C50 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C52 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C53 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12C54 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A12CR1 | 15077 | LED, RED STD BRIGHT DIFFUSED | AND | AND124R |
| A12P1 | 19181-002 | CONN DIN MALE C ANG(ABC) 96POS | PANDUIT | 100-096-053 |
| A12P2 | 19180-001 | CONN DIN MALE B ANG(AB)64 POS | PANDUIT | 100-064-053 |
| A12R1 | 10013-030 | RES DEP CARB 2.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R2 | 10013-061 | RES DEP CARB 1M OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R3 | 10013-063 | RES DEP CARB 1.5M OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R4 | 10013-018 | RES DEP CARB 270 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R5 | 10013-055 | RES DEP CARB 330K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R6 | 10142-004 | RES CARB COMP 22M OHM 5% 1/4W | LARTRONICS, INC. | RC070F226J |
| A12R7 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R8 | 10013-078 | RES DEP CARB 2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R9 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R13 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R14 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R15 | 10013-078 | RES DEP CARB 2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R16 | 10013-078 | RES DEP CARB 2K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R17 | 10013-001 | RES DEP CARB 10 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12R18 | 10013-001 | RES DEP CARB 10 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A12RP1 | 15098-002 | RES NETWORK 10K OHM 2% 1/8W | ALLEN-BRADLEY CO. | 108A103 |
| A12S1 | 15399 | SWITCH SPDT MOMENT. PC MNT | GRAYHILL | 39-251 |
| A12TP1 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A12TP2 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A12TP3 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A12TP4 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A12U7 | 13871 | INTEGRATED CKT LM555CH | NATIONAL SEMICONDUCTOR | LM555CN |
| A12U8 | 13470-011 | INTEGRATED CKT SN74LS38N | TEXAS INSTRUMENTS | SN74LS38N |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A12U9 | 13470-056 | INTEGRATED CKT SN74LS393N | TEXAS INSTRUMENTS | SN74LS393N |
| A12U10 | 13470-039 | INTEGRATED CKT SN74LS11N | TEXAS INSTRUMENTS | SN74LS11N |
| A12U11 | 13470-048 | INTEGRATED CKT SN74LS93N | MOTOROLA (SPD) | SN74LS93N |
| A12U12 | 13470-048 | INTEGRATED CKT SN74LS93N | MOTOROLA (SPD) | SN74LS93N |
| A12U13 | 13470-005 | INTEGRATED CKT SN74LS08N | TEXAS INSTRUMENTS | SN74LS08N |
| A12U20 | 13470-013 | INTEGRATED CKT SN74LS74N | TEXAS INSTRUMENTS | SN74LS74N |
| A12U21 | 13470-056 | INTEGRATED CKT SN74LS393N | TEXAS INSTRUMENTS | SN74LS393N |
| A12U22 | 20300 | PAL, ARB CONTROL INTERUPT | WAVETEK MICROWAVE | PER WMI #20300 |
| A12U23 | 20612 | PAL,ADRS DCDR/PRPHL SELECT | WAVETEK MICROWAVE | 20612 |
| A12U24 | 17023 | INTEGRATED CKT MC146818P | MOTOROLA (SPD) | MC146818P |
| A12U25 | 13470-060 | INTEGRATED CKT SN74LS164N | TEXAS INSTRUMENTS | SN74LS164N |
| A12U27 | 17114 | IC, GPIB CONTROLLER | TEXAS INSTRUMENTS | TMS9914ANL |
| A12U28 | 13470-047 | INTEGRATED CKT SN74LS32N | TEXAS INSTRUMENTS | SN74LS32N |
| A12U29 | 17117 | IC, A.C.I.A., 1.0MHZ | MOTOROLA (SPD) | MC6850P |
| A12U30 | 17044-001 | I.C. - MICROPROCESSOR | HITACHI | HD68000-8 |
| A12U31 | 13470-004 | INTEGRATED CKT SN74LS04N | TEXAS INSTRUMENTS | SN74LS04N |
| A12U32 | 13470-001 | INTEGRATED CKT SN74LS00N | TEXAS INSTRUMENTS | SN74LS00N |
| A12U33 | 17116 | IC QUAD LINE RECEIVER | MOTOROLA (SPD) | MC1489P |
| A12U34 | 17118 | IC QUAD LINE DRIVER | MOTOROLA (SPD) | MC1488P |
| A12U35 | 17113-002 | IC, OCTAL GPIB XCVR | TEXAS INSTRUMENTS | SN75162AN |
| A12U36 | 17113-001 | IC, OCTAL GPIB XCVR | TEXAS INSTRUMENTS | SN75160AN |
| A12U37 | 13470-047 | INTEGRATED CKT SN74LS32N | TEXAS INSTRUMENTS | SN74LS32N |
| A12U38 | 13470-003 | INTEGRATED CKT SN74LS02N | TEXAS INSTRUMENTS | SN74LS02N |
| A12U39 | 13470-066 | IC 8-INPUT PRIORITY ENCODER | TEXAS INSTRUMENTS | SN74LS348N |
| A12U40 | 11270-034 | INTEGRATED CKT 7407 | TEXAS INSTRUMENTS | SN7407N |
| A12U41 | 13470-049 | INTEGRATED CKT SN74LS244N | TEXAS INSTRUMENTS | SN74LS244N |
| A12U42 | 13470-049 | INTEGRATED CKT SN74LS244N | TEXAS INSTRUMENTS | SN74LS244N |
| A12U43 | 13470-049 | INTEGRATED CKT SN74LS244N | TEXAS INSTRUMENTS | SN74LS244N |
| A12U44 | 13470-049 | INTEGRATED CKT SN74LS244N | TEXAS INSTRUMENTS | SN74LS244N |
| A12U45 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A12U46 | 13470-061 | INTEGRATED CKT SN74LS245N | TEXAS INSTRUMENTS | SN74LS245N |
| A12U47 | 13470-001 | INTEGRATED CKT SN74LS00N | TEXAS INSTRUMENTS | SN74LS00N |
| A12XW1 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A12XW2 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A12XW3 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A12XW4 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A12XW5 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A12XW6 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A12XW7 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A12XW8 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A12XW9 | 14514-001 | MOD 2 POST | AMP, INC. | 87022-1 |
| A12Y1 | 15039 | I C OSCILLATOR | MIDLAND ROSS | VALU1-16MHZ |
| A12Y2 | 17047-001 | CRYSTAL, QUARTZ 32.768 KHZ | SARONIX | NTF3226E |

## REAR PANEL PC BOARD ASSEMBLY #19142

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A13C1 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C2 | 15640-010 | CAP CER USTBLE 33PF 10% 100V | MURATA/ERIE CORP | RPE110C00330K100V |
| A13C3 | 14119-006 | CAP POLYSTY 4700PF 2.5% 160V | MALLORY | SXM247 |
| A13C4 | 14119-006 | CAP POLYSTY 4700PF 2.5% 160V | MALLORY | SXM247 |
| A13C5 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C6 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C7 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A13C8 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C9 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C10 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C11 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C12 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C13 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C14 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C15 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C16 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A13C17 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C18 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C19 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C20 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C21 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A13C22 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A13C23 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A13C24 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C25 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A13C26 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A13C27 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C28 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C29 | 19598-002 | CAP ELCTLT RDL 47uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E470MAA |
| A13C30 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C31 | 19598-002 | CAP ELCTLT RDL 47uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E470MAA |
| A13C32 | 19598-001 | CAP ELCTLT RDL 470uF 20% 25V | NICHICON (AMERICA) CORP. | ULB1E471MRA |
| A13C33 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A13C36 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C37 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C38 | 15640-010 | CAP CER USTBLE 33PF 10% 100V | MURATA/ERIE CORP | RPE110C0G330K100V |
| A13C39 | 15640-010 | CAP CER USTBLE 33PF 10% 100V | MURATA/ERIE CORP | RPE110C0G330K100V |
| A13C41 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C42 | 15776-005 | CAP,CER 0.1 MF 10% 50V | CENTRALAB | CW20C104K |
| A13C44 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A13C45 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A13C46 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A13C47 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A13C48 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A13C49 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A13C50 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A13C51 | 15776-002 | CAP, CER .001 MF 10% 50V | CENTRALAB | CW15C102K |
| A13C52 | 15776-007 | CAP,CER. 470PF 10% 50V | CENTRALAB | CW15C471K |
| A13C53 | 15776-007 | CAP,CER. 470PF 10% 50V | CENTRALAB | CW15C471K |
| A13C54 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A13CR1 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A13CR2 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A13CR4 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A13CR5 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A13CR6 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A13CR7 | 10043 | DIODE 1N4148/1N914 | FAIRCHILD | 1N4148 |
| A13F1 | 20516-001 | FUSE, PTC RESET 10 OHM 20% | KEYSTONE CARBON CO. | RL3005-10-110-12-PTF |
| A13F2 | 20516-001 | FUSE, PTC RESET 10 OHM 20% | KEYSTONE CARBON CO. | RL3005-10-110-12-PTF |
| A13J1 | 19182-003 | CONN HDR MALE PCB W/LK 40 POS | 3M COMPANY | 3432-6202 |
| A13J2 | 19184-001 | CONN,RBN,PC/PNL MTG 50POS | AMP, INC. | 554217-3 |
| A13J3 | 19183-003 | CONN HDR HSG MATE-N-LOK 10POS | AMP, INC. | 1-380991-0 |
| A13J4 | 19184-002 | CONN,RBN,RCPT,PC/PNL MTG 36POS | AMP, INC. | 554400-3 |
| A13J5 | 17712-001 | CONN BNC JACK VERT PCB-PNL MTG | WAVETEK MICROWAVE | PER WMI# 17712-001 |
| A13J6 | 17712-001 | CONN BNC JACK VERT PCB-PNL MTG | WAVETEK MICROWAVE | PER WMI# 17712-001 |
| A13J7 | 17712-001 | CONN BNC JACK VERT PCB-PNL MTG | WAVETEK MICROWAVE | PER WMI# 17712-001 |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A13J8 | 17712-001 | CONN BNC JACK VERT PCB-PNL MTG | WAVETEK MICROWAVE | PER WMI# 17712-001 |
| A13J9 | 17712-001 | CONN BNC JACK VERT PCB-PNL MTG | WAVETEK MICROWAVE | PER WMI# 17712-001 |
| A13J10 | 17712-001 | CONN BNC JACK VERT PCB-PNL MTG | WAVETEK MICROWAVE | PER WMI# 17712-001 |
| A13J11 | 17712-001 | CONN BNC JACK VERT PCB-PNL MTG | WAVETEK MICROWAVE | PER WMI# 17712-001 |
| A13J12 | 19477-001 | CONN HDR POST STR LOCK 2POS | AMP, INC. | 640456-2 |
| A13R1 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R2 | 10015-003 | RES MET FILM 49.9 OHM 1% 1/8W | LARTRONICS, INC. | RN55D 49.9 OHM 1% 1/8W |
| A13R3 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R4 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R5 | 10013-045 | RES DEP CARB 47K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R6 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R7 | 15142-009 | RES VAR CERM 200 OHM 10% 1/2W | BECKMAN | 67XR200 |
| A13R8 | 10015-267 | RES MET FILM 51.1 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 51.1 OHM 1% 1/8W |
| A13R9 | 10015-267 | RES MET FILM 51.1 OHM 1% 1/8W | CORNING GLASS WORKS | RN55D 51.1 OHM 1% 1/8W |
| A13R10 | 12449-021 | RES MF 10.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A13R11 | 12449-021 | RES MF 10.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A13R12 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R13 | 12449-114 | RES MF 40.20K OHM,0.1%,1/8W | ACI | EE1/8C2 |
| A13R14 | 12449-126 | RES MF 22.00K OHM 0.1% 1/8W | PRECISION RESISTIVE PRODU | GP1/4T100 22.00K 0.1% |
| A13R15 | 12449-126 | RES MF 22.00K OHM 0.1% 1/8W | PRECISION RESISTIVE PRODU | GP1/4T100 22.00K 0.1% |
| A13R16 | 12449-114 | RES MF 40.20K OHM,0.1%,1/8W | ACI | EE1/8C2 |
| A13R17 | 10013-006 | RES DEP CARB 27 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R18 | 12449-053 | RES MF 50.00K OHM 0.1% 1/8W | DALE ELECTRONICS | MMF 1/8 T2 |
| A13R19 | 12449-127 | RES MF 16.60K OHM 0.1% 1/8W | PRECISION RESISTIVE PRODU | CP1/4T100 16.60K 0.1% |
| A13R20 | 12449-029 | RES MF 25.0K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A13R21 | 12449-029 | RES MF 25.0K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A13R22 | 12449-053 | RES MF 50.00K OHM 0.1% 1/8W | DALE ELECTRONICS | MMF 1/8 T2 |
| A13R23 | 12449-127 | RES MF 16.60K OHM 0.1% 1/8W | PRECISION RESISTIVE PRODU | CP1/4T100 16.60K 0.1% |
| A13R24 | 10013-006 | RES DEP CARB 27 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R25 | 10013-020 | RES DEP CARB 390 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R27 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R28 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R29 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R30 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R31 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R32 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R33 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R34 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R37 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R38 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R39 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R40 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R41 | 10013-017 | RES DEP CARB 220 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R42 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R43 | 10013-017 | RES DEP CARB 220 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R44 | 10013-037 | RES DEP CARB 10K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R45 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R46 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R47 | 10013-033 | RES DEP CARB 4.7K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R50 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R51 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A13R52 | 12449-021 | RES MF 10.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A13R53 | 12449-037 | RES MF 20.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A13R54 | 12449-021 | RES MF 10.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A13R56 | 10013-023 | RES DEP CARB 680 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R57 | 10013-096 | RES DEP CARB 20K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R59 | 10013-023 | RES DEP CARB 680 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R60 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R61 | 10013-096 | RES DEP CARB 20K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A13R62 | 10013-025 | RES DEP CARB 1K OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R64 | 10013-013 | RES DEP CARB 100 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R65 | 12449-037 | RES MF 20.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A13R66 | 10013-013 | RES DEP CARB 100 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R67 | 10013-013 | RES DEP CARB 100 OHM 5% 1/4W | MEPCO/ELECTRA | RC072FxxxJ |
| A13R68 | 10241-003 | RES CARB COMP 4.7 OHM 5% 1/2W | MEPCO/ELECTRA | RC-1/2-4R7J |
| A13R69 | 10241-003 | RES CARB COMP 4.7 OHM 5% 1/2W | MEPCO/ELECTRA | RC-1/2-4R7J |
| A13R70 | 12449-037 | RES MF 20.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A13R71 | 12449-037 | RES MF 20.00K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A13S1 | 12483-001 | SWITCH SPST PUSHBUTTON PCB MTG | GRAYHILL | 39-424BLK |
| A13TP1 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A13TP2 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A13TP3 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A13TP4 | 14320-002 | TEST JACK PIN | OVERLAND PRODUCTS | 330.100 W/TIN PLATE |
| A13U1 | 14641 | INTEGRATED CKT 8255 | HARRIS CORP | CP82C55A |
| A13U2 | 17048-013 | I.C. DUAL D-TYPE FLIP FLOP | TEXAS INSTRUMENTS, INC. | 74HCT74N |
| A13U3 | 20298 | PAL, REAR PANEL ADRS DECODER | WAVETEK MICROWAVE | PER WMI #20298 |
| A13U4 | 17048-012 | I.C. QUAD 2-INPUT NAND GATE | SIGNETICS | 74HCT03 |
| A13U5 | 13470-001 | INTEGRATED CKT SN74LS00N | TEXAS INSTRUMENTS | SN74LS00N |
| A13U6 | 17021 | I.C. - DIGITAL TTL | ANALOG DEVICES | AD574AJN |
| A13U7 | 17035 | I.C. - DIGITAL TTL | ANALOG DEVICES | AD7534JN |
| A13U8 | 15135 | INTEGRATED CKT HA7-5135-5 | PRECISION MONOLITHICS | OP-07/CP |
| A13U9 | 15135 | INTEGRATED CKT HA7-5135-5 | PRECISION MONOLITHICS | OP-07/CP |
| A13U10 | 15135 | INTEGRATED CKT HA7-5135-5 | PRECISION MONOLITHICS | OP-07/CP |
| A13U11 | 15135 | INTEGRATED CKT HA7-5135-5 | PRECISION MONOLITHICS | OP-07/CP |
| A13U12 | 15119 | INTEGRATED CKT DG201CJ | SILICONIX | DG201ACJ |
| A13U13 | 16325 | INTEGRATED CKT LF398AN | SIGNETICS | LF398N |
| A13U14 | 16325 | INTEGRATED CKT LF398AN | SIGNETICS | LF398N |
| A13U15 | 19490 | INTEGRATED CKT MC34074 | MOTOROLA (SPD) | MC34074P |
| A13U16 | 20281 | I.C. DUAL 12-BIT DAC | ANALOG DEVICES | AD7537JN |
| A13U17 | 19490 | INTEGRATED CKT MC34074 | MOTOROLA (SPD) | MC34074P |
| A13U18 | 20282 | I.C. DUAL SW PWR AUDIO AMP | NATIONAL SEMICONDUCTOR | LM2878P |

## MODULATOR PC BOARD ASSEMBLY #19943

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A14A1C1 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A14A1C2 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A14A1C3 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A14A1C4 | 15776-001 | CAP, CER .01MF 10% 50V | CENTRALAB | CW15C103K |
| A14A1C5 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A14A1C6 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A14A1C7 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A14A1C8 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A14A1C9 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A14A1C10 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A14A1C11 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A14A1C12 | 11501-002 | CAP CER 0.1MF 20% 50V | MURATA/ERIE CORP | RPE 122Z5U 104M50V |
| A14A1C13 | 15776-006 | CAP, CERAM. .47UF +- 10% 50V | CENTRALAB | CW40C4T4K |
| A14A1J1 | 19941-001 | CONN HDR ANG 2ROWS .10SP 14POS | AMP, INC. | 103024-7 |
| A14A1J2 | 19941-001 | CONN HDR ANG 2ROWS .10SP 14POS | AMP, INC. | 103024-7 |
| A14A1J3 | 19941-001 | CONN HDR ANG 2ROWS .10SP 14POS | AMP, INC. | 103024-7 |
| A14A1J4 | 19941-001 | CONN HDR ANG 2ROWS .10SP 14POS | AMP, INC. | 103024-7 |
| A14A1J5 | 19477-005 | CONN HDR POST STR LOCK 8POS | AMP, INC. | 640456-8 |

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A14A1J6 | 19477-005 | CONN HDR POST STR LOCK 8POS | AMP, INC. | 640456-8 |
| A14A1J7 | 19477-005 | CONN HDR POST STR LOCK 8POS | AMP, INC. | 640456-8 |
| A14A1J8 | 19477-005 | CONN HDR POST STR LOCK 8POS | AMP, INC. | 640456-8 |
| A14A1R1 | 12449-033 | RES MF 100K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A14A1R2 | 12449-033 | RES MF 100K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A14A1R3 | 10015-339 | RES MET FILM 2.21M 1% 1/8W | LARTRONICS, INC. | RN55D 2.21M 1% 1/8W |
| A14A1R4 | 12449-033 | RES MF 100K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A14A1R5 | 12449-033 | RES MF 100K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A14A1R6 | 10015-339 | RES MET FILM 2.21M 1% 1/8W | LARTRONICS, INC. | RN55D 2.21M 1% 1/8W |
| A14A1R7 | 12449-033 | RES MF 100K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A14A1R8 | 12449-033 | RES MF 100K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A14A1R9 | 10015-339 | RES MET FILM 2.21M 1% 1/8W | LARTRONICS, INC. | RN55D 2.21M 1% 1/8W |
| A14A1R10 | 12449-033 | RES MF 100K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A14A1R11 | 12449-033 | RES MF 100K OHM 0.1% 1/8W | ACI | EE 1/8 C2 |
| A14A1R12 | 10015-339 | RES MET FILM 2.21M 1% 1/8W | LARTRONICS, INC. | RN55D 2.21M 1% 1/8W |
| A14A1R13 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A14A1R14 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A14A1R15 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A14A1R16 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A14A1R17 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A14A1R18 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A14A1R19 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A14A1R20 | 10142-008 | RES CARB COMP 47 OHM 5% 1/4W | LARTRONICS, INC. | RC07GF470J |
| A14A1U1 | 17606-001 | IC QUAD SPST ANALOG SW(LO-PWR) | MAXIM INTEGRATED PRODUCTS | DG211CJ |
| A14A1U2 | 17606-001 | IC QUAD SPST ANALOG SW(LO-PWR) | MAXIM INTEGRATED PRODUCTS | DG211CJ |
| A14A1U3 | 17606-001 | IC QUAD SPST ANALOG SW(LO-PWR) | MAXIM INTEGRATED PRODUCTS | DG211CJ |
| A14A1U4 | 17606-001 | IC QUAD SPST ANALOG SW(LO-PWR) | MAXIM INTEGRATED PRODUCTS | DG211CJ |
| A14A1U5 | 20104 | IC 3-TERM POS VOLT REG | MOTOROLA (SPD) | MC78L05CP |

## CRT SOCKET PC BOARD ASSEMBLY #20038

| Reference Designator | Part Number | Description | Manufacturer | Manuf. Part Number |
|---|---|---|---|---|
| A15J1 | 19477-001 | CONN HDR POST STR LOCK 2POS | AMP, INC. | 640456-2 |
| A15P1 | 20054 | SOCKET, CRT | SONY MFG CO OF AMERICA | 1-562-869-11 |
| A15W1 | 20080 | CATHODE BD-CRT CABLE ASSEMBLY | WAVETEK MICROWAVE | PER WMI #20080 |
| A15W2 | 20081 | CATHODE BD-CRT CABLE ASSY | WAVETEK MICROWAVE | PER WMI #20081 |

MP MASTER
MA33286